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Toxic and Hazardous Materials Agency

Remedial Investigation Concept Plan for Picatinny Arsenal

Volume 1: Environmental Setting, Applicable Regulations, Summaries of Site Sampling Plans, Sampling Priorities, and Supporting Appendixes

APR

March 1991 *(Final Report)*

Environmental Assessment and Information Sciences Division
Argonne National Laboratory, Argonne, Illinois 60439-4801

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Volume 1: Environmental Setting, Applicable Regulations, Summaries of Site Sampling Plans, Sampling Priorities, and Supporting Appendixes

by P.A. Benioff, M.H. Bhattacharyya,* C. Biang, S.Y. Chiu, S. Miller, T. Patton, R. Pearl, A. Yonk, and C.R. Yuen

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Argonne National Laboratory, Argonne, Illinois 60439-4801

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Argonne National Laboratory has prepared a Remedial Investigation (RI) Concept Plan for Picatinny Arsenal in New Jersey. Based on types of activity and location, the 156 RI Sites identified during the study are grouped into 16 Areas. The plan assesses the environmental status and identifies additional data needed for each RI Site in each Area. The plan was developed to comply with state and federal hazardous waste and water quality regulations. The plan also provides a ranking of the 16 Areas according to their potential for impacts on public health and the environment. Volume 1 describes the environmental setting of Picatinny Arsenal, discusses applicable federal and state environmental regulations, briefly describes the Areas and the Sites within each Area, provides a ranking of the Areas, summarizes the proposed RI sampling plan for each Site in each Area, and gives supplementary information. Volume 2 describes the history, geology and hydrology, existing contamination, closure plan (if any), and proposed RI plan for each Site within each Area.

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ACRONYMS, INITIALISMS, AND ABBREVIATIONS

ANL	Argonne National Laboratory
App.	appendix
ARAR	applicable or relevant and appropriate requirement
ARDEC	Armament Research, Development and Engineering Center
BDAT	best demonstrated available technology
Bldg.	building
BTX	benzene, toluene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
Chap.	chapter
2,4-D	2,4-dichlorophenoxyacetic acid
DDT	dichlorodiphenyltrichloroethane
DEH	Division of Engineering and Housing
Div.	division
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DRMO	Defense Reutilization and Marketing Office
DU	depleted uranium
EC_{50}	effective concentration 50
EM	electromagnetic
EOD	explosive ordnance demolition
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
Fed. Reg.	Federal Register
Fig.	figure
HEPA	high-efficiency particulate air (filter)
HMX	cyclotetramethylene tetranitramine
HSWA	Hazardous and Solid Waste Amendments of 1984
ISAL	interim soil action level
LC_{50}	lethal concentration 50
LD_{50}	lethal dose 50
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MH	manhole
MSL	mean sea level

N	nitrogen
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
No.	number
NPL	National Priorities List
PCB	polychlorinated biphenyl
PTA	Picatinny Arsenal
RCRA	Resource Conservation and Recovery Act of 1976
RDX	hexahydro-1,3,5-trinitro-1,3,4-triazine (also known as cyclonite and cyclotrimethylenetrinitramine)
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
Rm.	room
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
Sec.	section
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TECUP	Toxic Energetics Cleanup Program
tetryl	2,4,6-trinitrophenylmethylnitramine
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	total organic carbon
TOH	total organic hydrocarbons
TOX	total organic halogens
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
Vol.	volume
WWI	World War I
WWII	World War II

UNITS OF MEASURE

°C	degree(s) Celsius
Ci	curie(s)
cm^2	square centimeter(s)
d	day(s)
°F	degree(s) Fahrenheit
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
gal	gallon(s)
h	hour(s)
ha	hectare(s)
in.	inch(es)
kCi	kilocurie(s)
lb	pound(s)
L	liter(s)
m	meter(s)
mCi	millicurie(s)
mg	milligram(s)
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
mm	millimeter(s)
pCi	picocurie(s)
ppb	part(s) per billion
ppm	part(s) per million
s	second(s)
ton	short ton(s)
yr	year(s)
μCi	microcurie(s)
μg	microgram(s)

REMEDIAL INVESTIGATION CONCEPT PLAN FOR PICATINNY ARSENAL

SUMMARY

This plan assesses the environmental status and describes additional data needs for 156 Sites grouped into 16 Areas at Picatinny Arsenal (PTA) near Dover, New Jersey. The concept plan was developed to comply with the hazardous waste and water quality regulations of the state of New Jersey and federal regulations as stated in the Hazardous and Solid Waste Amendments (HSWA) of 1984 and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The report describes the study area, including the geological and hydrological aspects and the history and activities of PTA, and some aspects of the relevant state and federal regulations. The reasons for grouping Sites into the Area are given briefly for each Area. For each Site, a brief description of the history, geology, and hydrology is followed by a discussion of the available data and information pertaining to the existing contamination at the Site. Based on the existing data, a remedial investigation (RI) action plan is proposed for each Site. Each action plan describes additional data needed to adequately characterize and monitor existing and potential contamination at the Site.

The report also includes a ranking or prioritization of the 16 Areas in terms of their potential for impact on public health and the environment. The ranking has been approved by the U.S. Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection (NJDEP).

The report is divided into two volumes. Volume 1 contains descriptions of the study area and state and federal regulations, brief descriptions of the Areas and Sites and the process by which they were chosen, summaries of the proposed RI sampling plans, and a priority ranking of the Areas; also included are summaries of munitions loading production and chemical and radioactive materials usage at PTA. Volume 2 contains a description of the Site history, geology, and hydrology; the nature and extent of contamination; and the proposed RI plan for each Site in each Area. The ordering of Areas and of Sites within each Area is the same in the text and tables in both volumes.

Several sources of information were used to produce the report. The Site histories are based on information supplied by PTA personnel during interviews, information in closure plans and other reports, and information supplied by PTA. The descriptions of existing contamination are based on the interviews, closure plans, and available sampling data. The proposed RI plans are based on the existing data and the relevant state and federal regulations. For those Sites for which closure plans have already been developed, the RI plans are designed to complement closure sampling and avoid duplication of sampling activities. In Volume 2, the RI plans are also described in sufficient detail to constitute, in essence, a summary work plan.

1 INTRODUCTION

1.1 BACKGROUND

Picatinny Arsenal, officially known as the U.S. Army Armament Research, Development and Engineering Center (ARDEC), was established by the U.S. War Department in 1880. In the latter part of the 18th century, the arsenal area contained iron forges for producing cannon, shot, bar iron, and other materiel for George Washington's army during the American Revolution. Iron ore for the forges came from nearby iron mines, which were active in the 18th and 19th centuries. After the war, the forges continued to produce bar iron for several decades.

When PTA was established, it was used as a storage and powder depot. Later, it was expanded to assemble powder charges for cannons and to fill projectiles with maximite (a propellant). During World War I (WWI), PTA produced all sizes of projectiles. In the years following WWI, PTA began projectile melt-loading operations and began to manufacture pyrotechnic signals and flares on a production basis (War Plans Division 1931). During World War II (WWII), PTA produced artillery ammunition, bombs, high explosives, pyrotechnics, and other ordnance. After WWII, PTA's primary role became the research and engineering of new ordnance. However, during the Korean and Vietnam conflicts, PTA resumed the production and development of explosives, ammunition, and mine systems.

In recent years, PTA's mission has shifted to conducting and managing research, development, and life-cycle engineering and to acquiring assigned items and systems. This includes life-cycle procurement, production of some components of nuclear munitions, and support of other military weapons and weapon systems. The facility has virtually total responsibility for the research and development of all armament items.

Investigations of the quality of soils and groundwater within PTA's boundaries, such as those conducted by the U.S. Geological Survey (USGS), have identified several potential environmental problems. PTA, with the assistance of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), has been conducting environmental assessment and restoration activities at various potential hazardous waste sites located throughout PTA. However, assessments have not yet been completed to determine the spatial extent, magnitude, direction, and rate of contaminant migration in the aquifers beneath the disposal areas. To assess the current environmental status of PTA and determine the potential of off-site migration of contaminants, USATHAMA contracted Argonne National Laboratory (ANL) to prepare a RCRA/CERCLA* Concept Plan.

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*Resource Conservation and Recovery Act of 1976/Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

1.2 OBJECTIVE

The objective of this study is to develop a conceptual plan for a remedial investigation for PTA to protect human health and the environment. The U.S. Army, working with Region II of the EPA and the NJDEP, initially selected 55 Sites for further environmental characterization and remediation studies. An additional 101 Sites were selected based on the results of interviews by ANL staff and others with current and former PTA employees and review by USATHAMA. The interview information was also used to expand some of the original 55 Sites to include additional nearby areas or buildings. Based on location and types of activity carried out at each Site, the 156 Sites have been grouped into 16 Areas.

This RI concept plan presents an in-depth assessment of the current environmental status of each Site in each Area, a discussion of the need for site investigation, and a recommendation of possible alternatives for remedial action. The plan takes into account the listing of PTA on the National Priority List (i.e., as a Superfund site) in March 1990. This plan has been developed to comply with hazardous waste regulations of the NJDEP and with regulations stipulated in the HSWA of 1984 and the SARA of 1986. It will be used by the Army as a working document for accomplishing a comprehensive RI at each of the 16 Areas on PTA.

1.3 APPROACH

The study began when ANL staff visited PTA to acquaint themselves with its environment and to interview PTA personnel about the operational history and activities at each Site. Two additional visits were needed to complete the interviews and see the additional Sites. ANL staff searched the literature for available geohydrological and groundwater quality data, as well as data on soil contamination at the Sites. The data were used to characterize the hydrogeological conditions both at PTA as a whole and at each Site and to characterize the soil and groundwater contamination at each Site. All available data for samples collected before May 1989 were used in the study. May 1989 was also taken to be the cutoff date for data used in the study. Data quality and completeness were also evaluated.

The study further assessed the potential public health and environmental impacts associated with site contamination by comparing contaminant concentration levels with regulatory limits set forth by the EPA and NJDEP. The impact assessment results were used to identify additional data needed for each Site. This RI concept plan was then developed, based on existing environmental data, to identify the Sites requiring no further action, additional data, or periodic monitoring. For Sites requiring additional data or monitoring, phased sampling plans were developed. Analyses of remedial action needs and restoration alternatives are outside the scope of this study.

As a final step, the 16 Areas were ranked according to their need for remedial action. The ranking was based on existing data and site information and environmental criteria such as potential or actual risk to human health and the environment.

2 DESCRIPTION OF STUDY AREA

2.1 LOCATION AND GEOGRAPHY

Picatinny Arsenal is located about 4 mi north of the city of Dover in Rockaway Township, Morris County, New Jersey (Fig. 2.1). State Route 15 skirts the southern end of PTA; Interstate 80 is about 1 mi and U.S. Route 46 about 1.5 mi southeast of the main entrance.

The PTA land area consists of 6,491 improved and unimproved acres, of which 5,848 are in fee (in absolute and legal possession), 639 in restrictive easement, and 4 in lease. The arsenal is situated in an elongated valley trending northeast-southwest between Green Pond Mountain and Copperas Mountain on the northwest and an unnamed hill on the southeast. Within the boundaries of PTA, the land surface ranges in elevation from 1,240 ft above mean sea level (MSL) along the crest of Green Pond Mountain to just under 700 ft above MSL where Green Pond Brook leaves the Arsenal. The Green Pond and Copperas mountains rise precipitously above Picatinny Lake and Lake Denmark. Slopes on these mountains are steep and rugged. The slopes on the southeast side of the Arsenal with elevations approaching 1,000 ft above MSL are not as rugged or steep as other PTA slopes, however. Most of the PTA buildings and other facilities are located on the narrow valley floor or on the slopes along the southeast side. Several firing and testing ranges are located on Green Pond Mountain.

In general, the areas that surround the Arsenal are suburban and summer vacation areas because of the numerous small lakes and many mountains. The environs contain the densest population in Morris County. Some of the nearby populous areas are Morristown, Morris Plains, Parsippany, Troy Hills, Randolph Township, and Sparta Township. Morris County political units in the immediate vicinity of PTA include:

- Wharton, a borough 3 mi south of PTA (population of about 5,500).
- Dover, a town 4 mi south of PTA (population of 15,000).
- Rockaway, a borough 4 mi southeast of PTA (population of 6,500).
- Denville, a township 6 mi southeast of PTA (population of 14,000).
- Boonton, a town 8 mi southeast of PTA and bisected by Routes 387 and 202 (population of about 9,000).
- Morristown, the county seat, 15 mi southeast of PTA (population of 18,000).

Lake Hopatcong is the largest lake in the state; it is situated in two counties, Morris and Sussex. This 9-mi^2 lake, together with a state park and an amusement park, is a favorite recreation area, and is located about 4 mi west of Picatinny Arsenal.

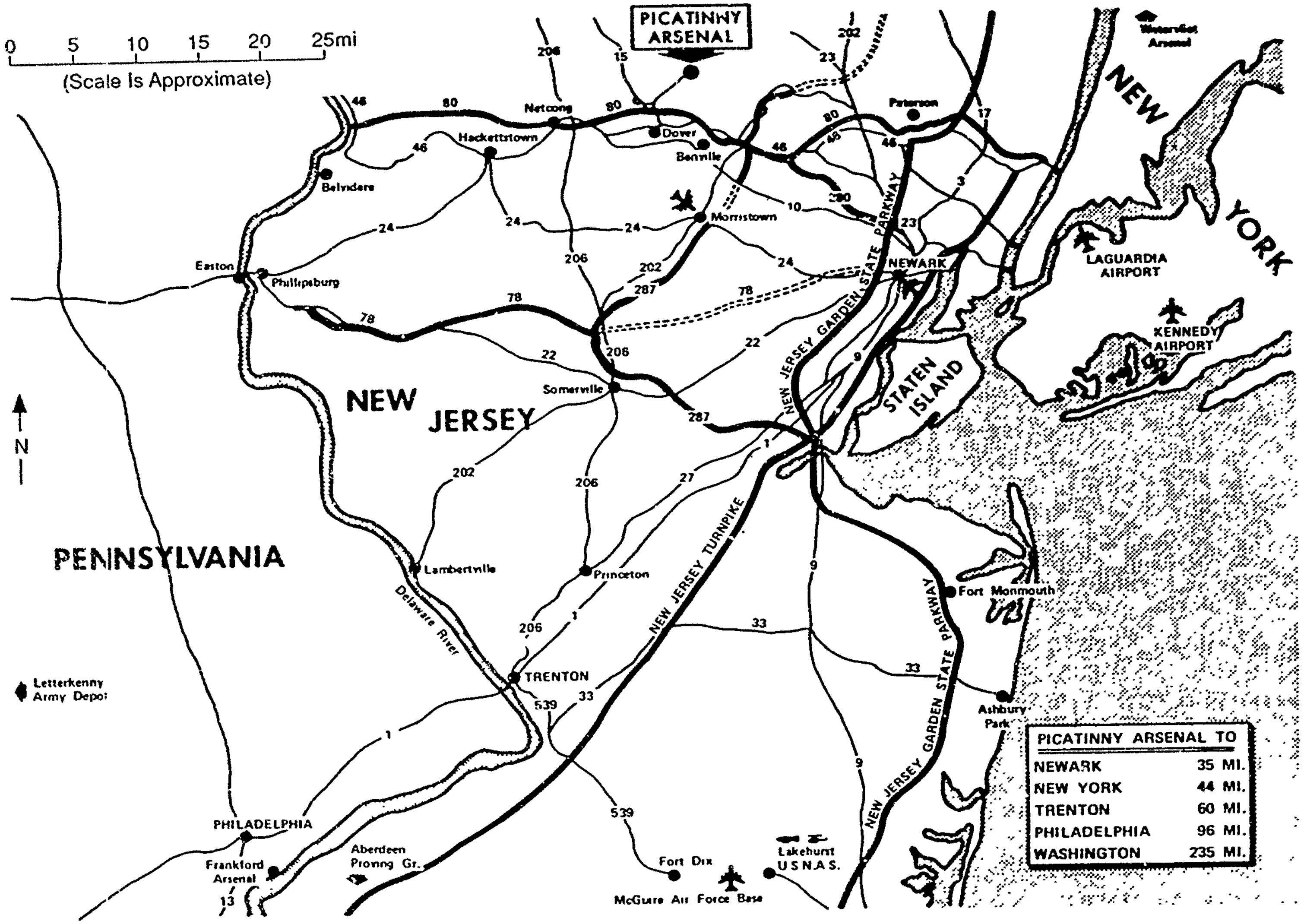

FIGURE 2.1 Location of Picatinny Arsenal (Source: USATHAMA 1976)

2.2 CLIMATE

The area around PTA, although humid and temperate, has a continental climate that is minimally influenced by the ocean. The temperature, wind, and precipitation data that follow were taken from 1951-1980 records at the nearest cooperative weather station, at Boonton (U.S. Department of Commerce 1982).

The temperature in summer seldom exceeds 100°F, but temperatures in the middle or upper 90s occur frequently. The highest mean annual temperature, 72.4°F, occurs during July. The coldest month is January, with an average of 27.4°F.

The average length of the growing season in Morris County is about 159 d. The average date of the last killing freeze in spring is May 2, and that of the first in fall is October 8 (Eby 1976).

The prevailing winds are from the northwest during the period October through April and from the southwest during the period March through September (Gill and Vecchioli 1965).

The mean annual precipitation is 47.85 in., and the monthly averages show that precipitation is well distributed throughout the year. Rainfall is heaviest in July and August. Much of the rainfall accompanies thunderstorms; the area has about 33 such storms per year (Eby 1976; U.S. Department of Commerce 1982).

2.3 SOILS AND GEOLOGY

2.3.1 Soils

Soils at PTA are acidic and predominantly derived from glacial deposits. However, the northwestern mountains contain rugged, rocky slopes and rough, stony land. The southern end of this mountain range and the easterly slopes across the valley are not as rugged and are composed mostly of stoney land and sandy clay loam. The central or valley section of PTA contains loam, silt, sand, and gravel clay pan soils, with considerable muck and peat in a swampy area. Practically all of the soils in the Arsenal's cantonment area are highly permeable. Figure 2.2 shows the areal distribution of PTA surface soil types, as mapped by the U.S. Department of Agriculture (USDA). Eighteen individual units, which are portrayed on the map, consist of loam, silt, sands, clays, gravels, and rock outcrops. Table 2.1 provides a description of each soil unit and its characteristics.

The southern end of PTA is bordered by a terminal moraine that has only a moderate topographic expression in the surrounding valley. These soils consist mainly of poorly sorted sands, gravels, and boulders. The western flank of PTA is blanketed by a thin layer of glacial till consisting of poorly sorted sands, gravels, and boulders. This layer may reach a thickness up to 20 ft in some areas. The eastern flanks have much gentler slopes and more uniform till, ranging from 10 to 25 ft thick. The valley is underlain by both till and drift, which consists of clay, sand, and gravel. The thickness of

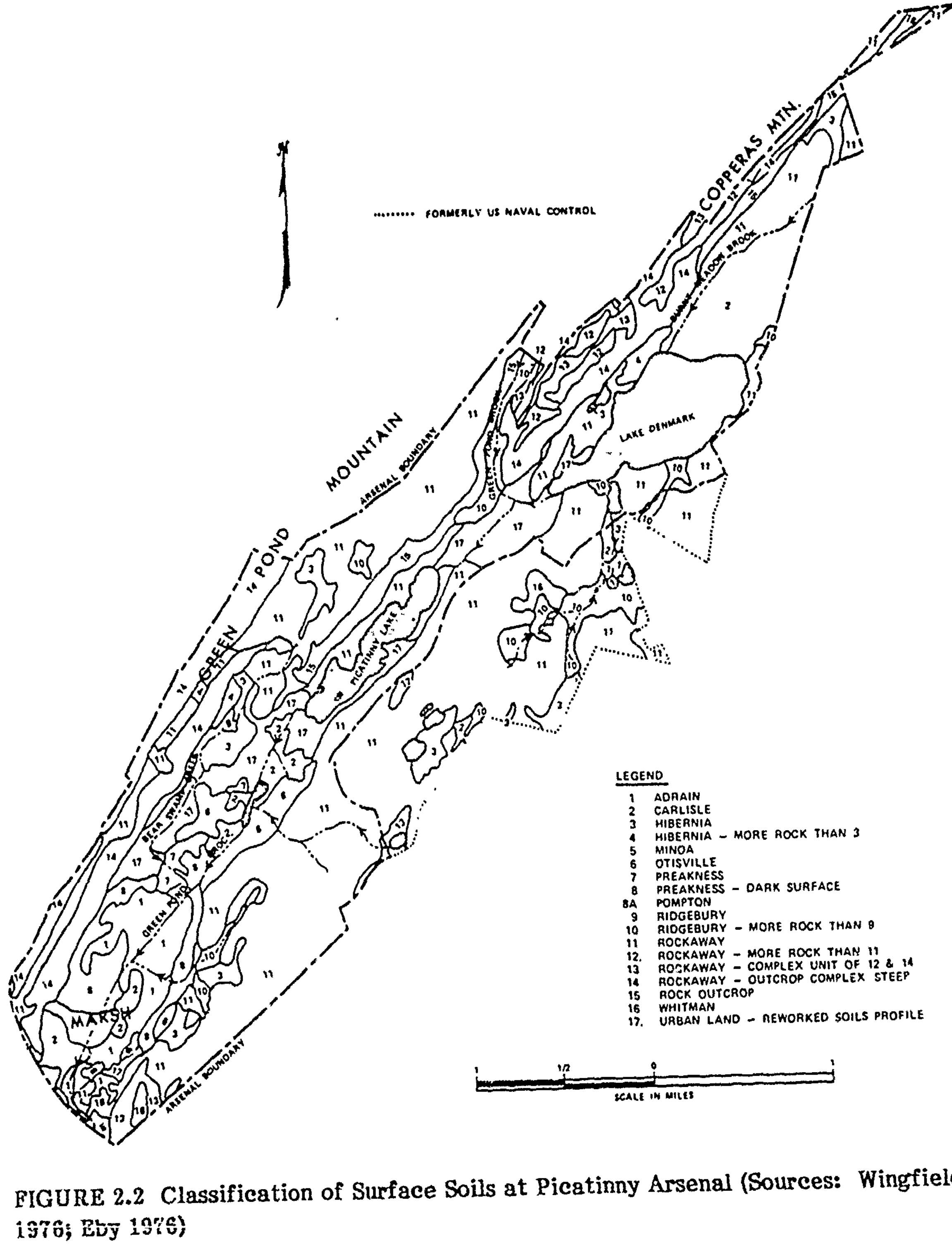

FIGURE 2.2 Classification of Surface Soils at Picatinny Arsenal (Sources: Wingfield 1976; Eby 1976)

TABLE 2.1 Characteristics of Surface Soil Units at PTA[a]

Map Unit[b]	Soil Series	Description	Typical Depth (in.)	USCS Classification[c]	Fractions Passing Sieve Numbers (%): No. 4, 4.7 mm	No. 10, 2.0 mm	No. 40, 0.42 mm	No. 200, 0.074 mm	Permeability (in./h)	Soil pH
1	Adrian	Very poorly drained organic soils, in depressions or kettles in the uplands having a muck surface texture and a brown peat subsurface layer over loamy sand substratum	0-42 42-60	Pt SM	- 90-100	- 85-100	- 50-75	- 15-30	6 6	5.6-6.5 5.6-6.5
2	Carlisle	Deep, very poorly drained black organic soils in depressions and beside upland streams; normally has a muck surface and brown subsurface layer several feet deep	0-60	Pt	Highly organic deposits				6	5.6-6.5
3	Hibernia	Deep, somewhat poorly drained loamy soils of the uplands formed in glacial till derived from granite gneiss; underlying rock is mostly gneiss	0-7 7-20 20-46 46-60	SM SM SM SM	70-85 70-90 70-90 80-95	65-75 65-80 65-80 60-75	55-70 60-75 55-70 55-70	30-45 25-45 25-45 25-35	0.6-2.0 0.6-2.0 0.2 0.2-0.6	4.5-5.5 4.5-5.5 4.5-5.5 4.5-5.5
4	Hibernia	Generally same as unit 3 but is classified as containing more rock								
5	Minoa	Deep, somewhat poorly drained soils of the Passaic basin soils having a silt loam surface texture and a mottled silt loam subsoil; substratum is a fine sand	0-6 6-30 30-60	ML,CL ML,CL SM,SC	90-100 95-100 95-100	85-100 85-100 85-100	60-80 80-95 75-90	60-80 45-85 15-80	0.6-2.0 0.2-2.0 0.6-6.0	5.6-7.0 5.1-6.5 6.7-7.3
6	Otisville	Deep, excessively drained sandy soil of the glacial uplands and outwash plains; the subsoil and substratum are gravelly loamy sand to very gravelly sand	0-14 14-60	SM,GM SP,SM SM,GM	55-70 55-80	50-80 50-80	30-45 20-35	10-20 10-25	6.0 6.0	4.5-6.0 4.5-6.0

TABLE 2.1 (Cont'd)

Map Unit[b]	Soil Series	Description	Typical Depth (in.)	USCS Classification[c]	Fractions Passing Sieve Numbers (%) No. 4, 4.7 mm	No. 10, 2.0 mm	No. 40, 0.42 mm	No. 200, 0.074 mm	Permeability (in./h)	Soil pH
7	Preakness	Deep, poorly drained grayish sandy soil on outwash plains and terraces	0-8	SM,SC	95-100	90-100	60-75	30-40	2.0-6.0	4.5-5.5
			8-30	SM,SC	85-100	90-100	35-50	30-40	2.0-6.0	4.5-5.5
			30-60	SP,SM SM	75-100	50-100	35-50	15-35	2.0-6.0	4.5-5.5
8	Preakness, dark surface	Dark surface variant is a moderately deep, very poorly drained grayish sandy soil formed in outwash plains	0-8	Pt	-	-	-	-	6.0	4.5-6.0
			8-32	SM	85-100	65-80	35-50	20-35	2.0-6.0	5.1-6.0
			32-60	SM,SP	60-100	55-100	35-50	10-30	2.0-6.0	4.0-6.0
8A	Pomptor	Deep, somewhat poorly drained moderately sandy soils of the uplands and outwash plains; substratum is sand and gravel	0-7	SM,SC	85-100	85-100	70-85	30-40	2.0-6.0	4.5-5.0
			7-36	SM	85-100	80-100	70-85	25-40	2.0-6.0	5.1-5.5
			36-60	SM,GM	70-100	60-100	60-90	10-25	6.0	4.5-5.5
9	Ridgebury	Deep, poorly drained stony soil with a very stony loam surface; moderately developed fragipan occurs 12-24 in. below the surface; underlying rock is gneiss	0-9	GM,GC, SM,SC	65-80	60-80	50-65	30-50	0.6-2.0	4.5-5.0
			9-14	SM,SC	80-95	65-80	60-75	30-45	0.6-2.0	4.5-5.0
			14-36	SM	85-95	65-80	55-70	25-40	0.2	4.5-5.0
			36-60	SM	85-100	65-80	60-75	25-40	0.6-2.0	4.5-5.5
10	Ridgebury	This unit has same characteristics as unit 9 but is classified as having a higher percentage of stones than unit 9								
11	Rockaway	Deep, moderately well drained soils of the uplands; subsoil is commonly gravelly loam or gravelly sandy loam; the lower part of the subsoil is a dense firm fragipan; water has a tendency to move laterally over the fragipan	0-8	SM,SC	70-85	60-75	55-70	25-40	0.6-2.0	4.5-5.5
			8-20	SM,SC	75-90	65-85	60-75	25-40	0.6-2.0	4.5-5.5
			20-40	SM,SC	75-90	65-80	55-70	25-45	0.2	4.5-5.5
			40-60	SM,SC	80-95	65-80	55-70	25-45	0.2-2.0	4.5-5.5

TABLE 2.1 (Cont'd)

Map Unit[b]	Soil Series	Description	Typical Depth (in.)	USCS Classification[c]	Fractions Passing Sieve Numbers (%) No. 4, 4.7 mm	No. 10, 2.0 mm	No. 40, 0.42 mm	No. 200, 0.074 mm	Permeability (in./h)	Soil pH
12	Rockaway	Extremely stony sandy loam (other data similar to unit 11)								
13	Rockaway	Rock outcrop complex								
14	Rockaway	Steep outcrop complex								
15	Rock outcrop	Large stones and boulders 724 in. in diameter	Not suitable for sampling							
16	Whitman	Deep, very poorly drained grayish soil in depressions and drainageways of glaciated uplands; soils are stony and have firm subsoil overlying a loamy sand or gravelly loamy sand	0-8	ML, CL, SM, SC	85-95	80-90	70-85	45-60	2.0-6.0	4.5-6.0
			8-20	ML, SM, CL, SC	80-95	75-90	75-90	45-60	0.6-2.0	4.5-6.0
			20-40	SM	80-95	75-90	65-80	30-50	0.2	4.5-6.0
			40-60	SM	80-95	75-90	65-80	15-30	0.2-2.0	4.5-6.0
17-18	Urban Land complex	Soil has been reworked so that the profile has been destroyed	Data not determined.							

[a]All units are characterized as having a low shrink-swell potential.

[b]See Fig. 2.2.

[c]Group symbols are as follows: CL = inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. GC = clayey gravels, gravel-sand-clay mixtures. GM = silty gravels, gravel-sand-silt mixtures, few or no fines. ML = inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity. SC = clayey sands, sand-clay mixtures. SM = silty sands, sand-silt mixtures. SP = poorly graded sands, gravelly sands, few or no fines. Pt = peat and other highly organic soils.

Sources: Wingfield 1976; USATHAMA 1976.

these deposits reaches 200 ft in depth, as shown in the generalized cross-section in Fig. 2.3.

2.3.2 Geology

PTA is located in the Green Pond syncline, a structural region within the New Jersey Highlands Physiographic Province. The New Jersey Highlands, or Reading Prong, is composed of a northeast-southwest system of folded and faulted Proterozoic-to-Devonian rocks that form a sequence of valleys and ridges. The ridges are typically broad, rounded, or flat-topped, and the valleys are typically deep and narrow. Generally, a 400- to 600-ft difference in altitude separates ridge crest from valley floor (Wolf 1977).

The Green Pond syncline is a narrow, northeast-trending, faulted syncline containing a thin section of Paleozoic sediments. Paleozoic rocks typically sit unconformably atop the Precambrian basement, on the eastern side of the syncline (Fig. 2.4). However, thrust faults and folds in the Paleozoic section have removed the original contact between the basement and cover rocks (Lyttle and Epstein 1987).

A significant strike-slip component of movement is possible on the normal faults in the Green Pond syncline (Lyttle and Epstein 1987). Two faults are of interest at PTA, the Green Pond and the Mount Hope. The Green Pond fault is longitudinal, running along and parallel to the trend of the western side of the valley (Sims 1958). The displacement is about 1,500 ft, with uplift on the west side and a dip steeply to the northwest (Kummel and Weller 1902). The Mount Hope fault runs across the valley trend and is a high-angle, strike-slip fault (horizontal movement). It has a general strike of north 78° west and an average dip of 60° southwest. Uplift is on the north side of the fault (Sims 1958). The

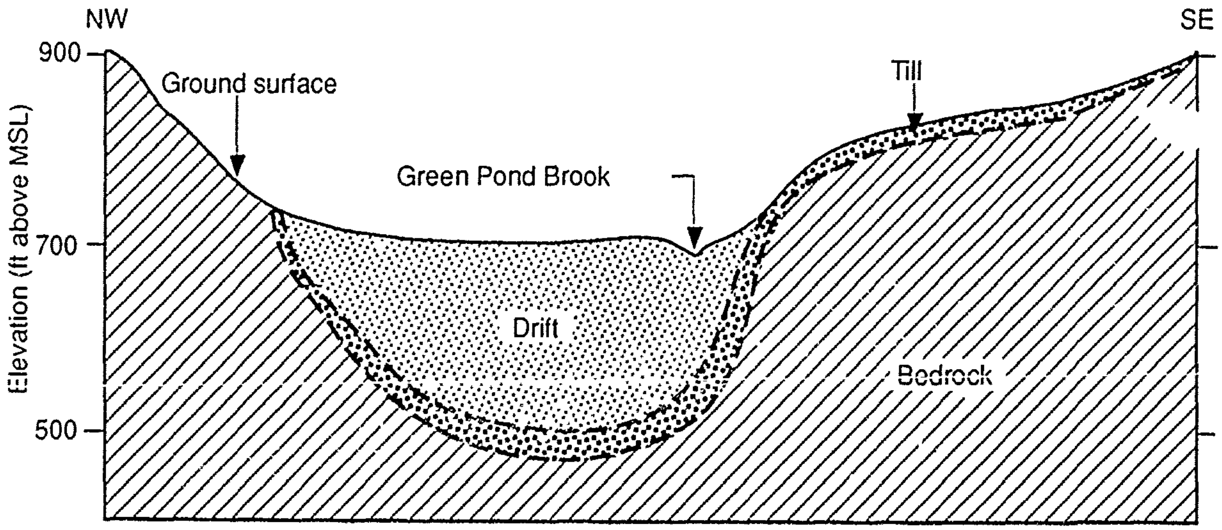

FIGURE 2.3 Generalized Cross-Section Showing the Surficial Deposits and Bedrock Southwest of Picatinny Lake (Sources: Adapted from Wingfield 1976; Vowinkel et al. 1985)

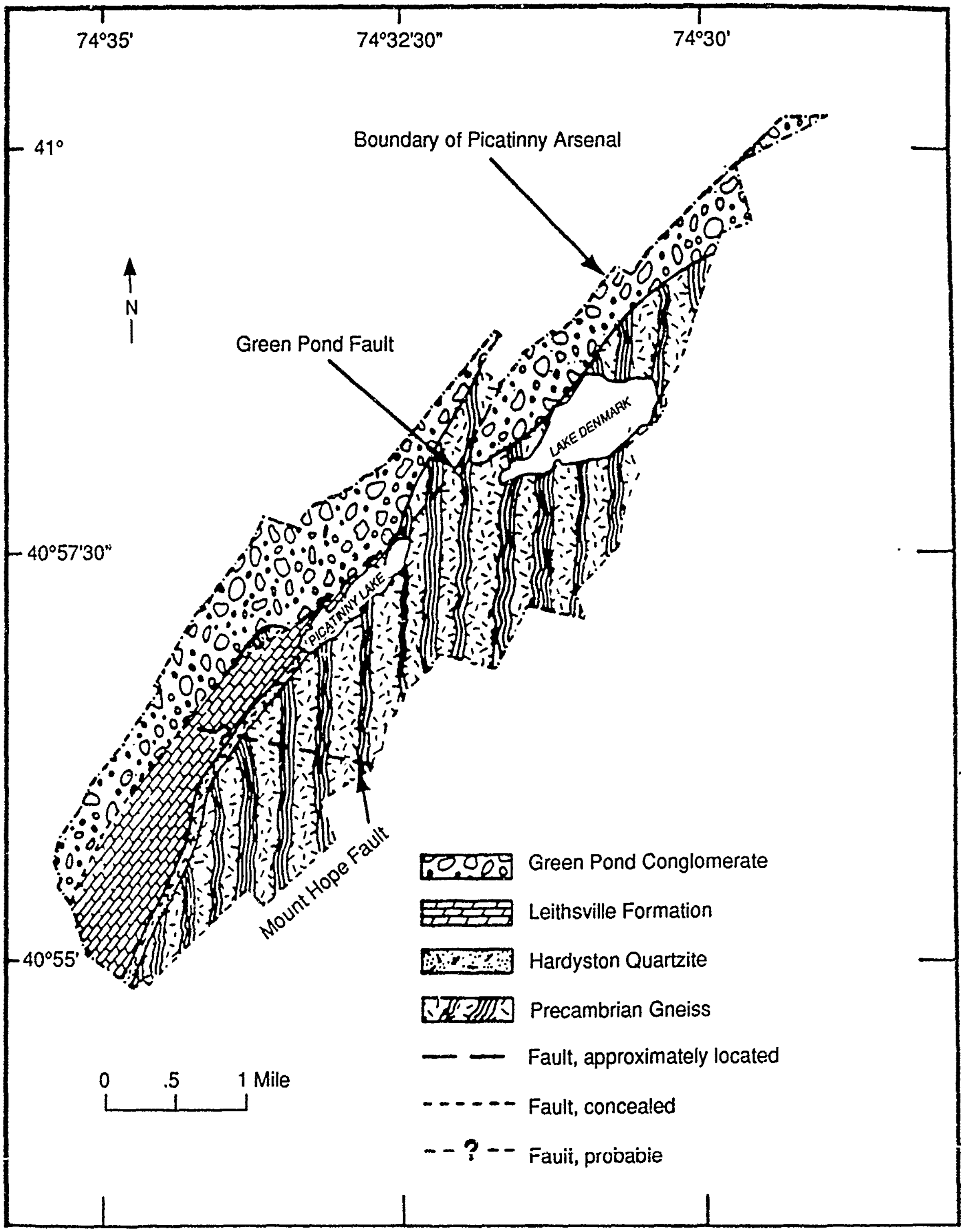

FIGURE 2.4 Generalized Bedrock Geology of Picatinny Arsenal (Source: Adapted from Vowinkel et al. 1985)

Mount Hope Mine shafts indicate little rotation of the fault, with little difference in its attitude and displacement between the surface and a depth of 2,100 ft. The net slip is about 300 ft. The fault in the mine workings is a brecciated and shattered zone 20-30 ft wide. Sims (1958) reported that the fault is very permeable and that a flow of several hundred gallons per minute will develop when the surface is intersected by a mine working. No evidence of this fault exists on the ground surface.

2.3.2.1 Bedrock

PTA is underlain by four bedrock formations ranging in age from Precambrian to Silurian. Throughout most of the area, especially in the valley, the bedrock is obscured by unconsolidated glacial till and stratified drift deposits of varying thickness (Vowinkel et al. 1985). A terminal glacial moraine occurs at the southwestern boundary of the arsenal (Vowinkel et al. 1985). Table 2.2 presents descriptions of rock units found in the vicinity of PTA.

The bedrock units and unconsolidated glacial deposits in the PTA area are gneiss and other metamorphic rocks (Precambrian), Hardyston quartzite (Cambrian), Leithsville dolomite (Cambrian), Green Pond Conglomerate (Silurian), and till and stratified drift (Pleistocene).

The hornblende granite and associated alaskite of Precambrian-age is the oldest basement unit, which is exposed at the southeastern entrance to the arsenal (Puffer 1980). The granite is pinkish to greenish buff, with a distinct gneissoid structure. It is composed principally of microperthite, quartz, hornblende, and plagioclase and has small amounts of magnetite, ilmenite, apatite, zircon, biotite, and fluorite (Puffer 1980). Numerous xenoliths and pemalites are present. The granite is mapped as an alaskite, with a mafic mineral content of less than 5% (by volume), and the alaskite facies is closely associated with magnetite ore deposits (mined east of PTA).

The Hardyston quartzite is a lower Cambrian fine- to medium-grained, white to dark-gray, thin- to medium-bedded, feldspathic quartzite interbedded with arkose, quartz-pebble conglomerate, and silty shale or phyllite. The lower contact with the Precambrian granite is generally unconformable and abrupt. Thickness of this unit ranges from 0 to 100 ft in New Jersey (Lyttle and Epstein 1987). The unit underlies a small area of the valley-fill glacial deposits and forms a narrow ridge on the eastern flank of PTA. It does not outcrop at PTA (Harte, Sargent, and Vowinkel 1986).

The Leithsville Formation is an Early to Middle Cambrian formation that consists of dolomite with some thin beds of quartz and dolomitic sandstone. Mud cracks, ripple marks, and graded beds are common in this formation (Wolf 1977). The lower contact is gradational with the underlying Hardyston quartzite. The Leithsville Formation underlies a large area of the valley fill deposits and outcrops on the western shore of Picatinny Lake (Harte, Sargent, and Vowinkel 1986).

The Leithsville Formation is subdivided into three members: the Wallkill, Hamburg, and Califon. The Califon member, which is the basal Leithsville unit, averages

TABLE 2.2 Generalized Stratigraphic Sequence and Associated Geohydrology of Rock Units at PTA

Geologic Era and Stratigraphic System and Series	Geologic Unit	Max. Thickness (ft)	Lithology	Geohydrology
Cenozoic era, Quaternary system:				
Holocene series	Alluvium	10	Ranges from sandy loam in the valley to stony gravel on hillsides	Too thin to be tapped
	Swamp deposits	30	Black, brown. and gray organic material	High permeability along organic layers
Pleistocene series	Stratified drift	200+	Present as glaciofluvial and glaciolacustrine deposits; mostly sand- to clay-size sediments; exhibits stratification and some rhythmic lamination	Yields depend on sorting and grain size; well-sorted, coarse-grained deposits are good aquifers and yield up to 2,200 gal/min; clay and silt deposits are generally unsuitable as aquifers
	Unstratified drift	100+	Present as ground, terminal, and recessional moraine; deposits are generally tightly packed and poorly sorted; grain sizes range from boulders to clay	Yields depend on sorting and packing; generally low yields
Paleozoic era: Silurian system	Green Pond conglomerate	1,500+	Unconformity: coarse quartz conglomerate interbedded with and grading upward into quartzite and sandstone; mostly massive and red, with some white and green beds	Generally yields small amounts of water from fractures and joints
Cambrian system Middle series	Leithsville formation	1,000	Unconformity: present mostly as light- to medium-gray, microcrystalline, locally stylolithic rock to fissile, siliceous to dolomitic micrite rock; often weathered to a medium-yellow silty clay	Contains water-bearing fractures and cavities that generally have moderate yields of up to 380 gal/min

TABLE 2.2 (Cont'd)

Geologic Era and Stratigraphic System and Series	Geologic Unit	Max. Thickness (ft)	Lithology	Geohydrology
Cambrian (cont'd) Lower series	Hardyston quartzite	200	Gradational: orthoquartzite to conglomerate; generally well indurated	Generally few fractures; yields small amounts of water
Precambrian era:	Alaskite		Medium- to coarse-grained predominantly granitoid gneiss composed principally of microperthite, quartz, and oligoclase, includes local bodies of microantiperthite granite and granite pegmatite; amphibolite inclusions are common	Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min
	Hornblende granite	Basement	Medium- to coarse-grained predominantly granitoid gneiss composed principally of microperthite, quartz, oligoclase, and hornblende; includes local bodies of biotite granite, hornblende granite gneiss, granodiorite, and granite pegmatite; amphibolite inclusions are common	Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min
	Biotite-quartz-feldspar gneiss		Varying composition of medium- to coarse-grained gneiss; predominant facies is composed of biotite, quartz, and oligoclase; minor facies are characterized by abundant garnet and microperthite, with local sillimanite and graphite	Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min

Sources: Sims 1958, Plate 1; Gill and Vecchioli 1965, Table 3; Vowinkel et al. 1985, as modified from Drake 1969, Table 20.

100 ft thick and is a light- to dark-gray, dense, fine- to medium-grained megacrystalline, locally laminated dolomite. The Hamburg member, 35-100 ft thick, is a dark- to light-gray, fine- to coarse-grained sandstone, siltstone, shale, and dense conchoidal-breaking dolomite. Overlying the Hamburg, the Wallkill member is a dark, gray, patchy dolomite with an estimated thickness of 350-500 ft (Markewicz and Dalton 1980).

The Green Pond Conglomerate is Upper Silurian in age, the youngest bedrock unit at the arsenal. Green Pond Mountain is composed primarily of this formation. This conglomerate is made up of gray and reddish-gray sandstone and conglomerate with predominantly white quartz and minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. The lower contact is separated from the Leithsville by the Green Pond fault. Conglomerate thickness varies from 984 to 1,394 ft (Lyttle and Epstein 1987).

2.3.2.2 Unconsolidated Sediments

Unconsolidated glacial deposits cover much of the bedrock throughout the New Jersey Highlands area. During the Pleistocene series, glaciers advanced from the north to cover much of the Highlands. During the last glacial stage, the Wisconsin, the glaciers only extended as far south as PTA. Evidence of this is noted by the 25- to 40-ft-high terminal moraine at the southeast corner of PTA. A recessional moraine is also located just south of Picatinny Lake (Harte, Sargent, and Vowinkel 1986).

As the glacial front retreated, the mountains and valleys became covered with a great variety of glacial till and stratified drift deposits; streams and lakes developed, depositing stratified sediments in the valley. These deposits, composed of interbedded layers of sand, silt, and clay, are formed under depositional environments different from the unstratified clay, silt, sand, gravel, and boulder till deposits.

At PTA, the drift thickness varies from 80 ft near Picatinny Lake to more than 185 ft at the southwestern boundary (Vowinkel et al. 1985). In general, the sediments become finer toward the southwest, where varved silts and clays of lacustrine origin are present.

The unstratified clay, silt, sand, gravel, and boulder till deposits are generally less than 25 ft thick where slopes are steep. The highland along the southeast side of the valley is covered with till 10-25 ft in thickness (Sargent 1988). The moraine contains generally poorly sorted and tightly packed sand or gravel in a silty clay matrix.

Test drilling at PTA by the USGS during the mid-1980s has shown that the bedrock is deeper than 125 ft below the ground surface. Vowinkel et al. (1985) report that a boulder bed was encountered while drilling the cafeteria well cluster, wells 242-245 (Fig. 2.5). Wells 129 and 130 (Fig. 2.6), drilled by Layne-NY in 1948, were originally thought to be screened at the top of the bedrock surface at about 125 ft below the ground surface (Vowinkel et al. 1985). However, the deep well at the cafeteria cluster indicated that wells 129 and 130 were actually terminated above a boulder bed more than 40 ft thick in some areas.

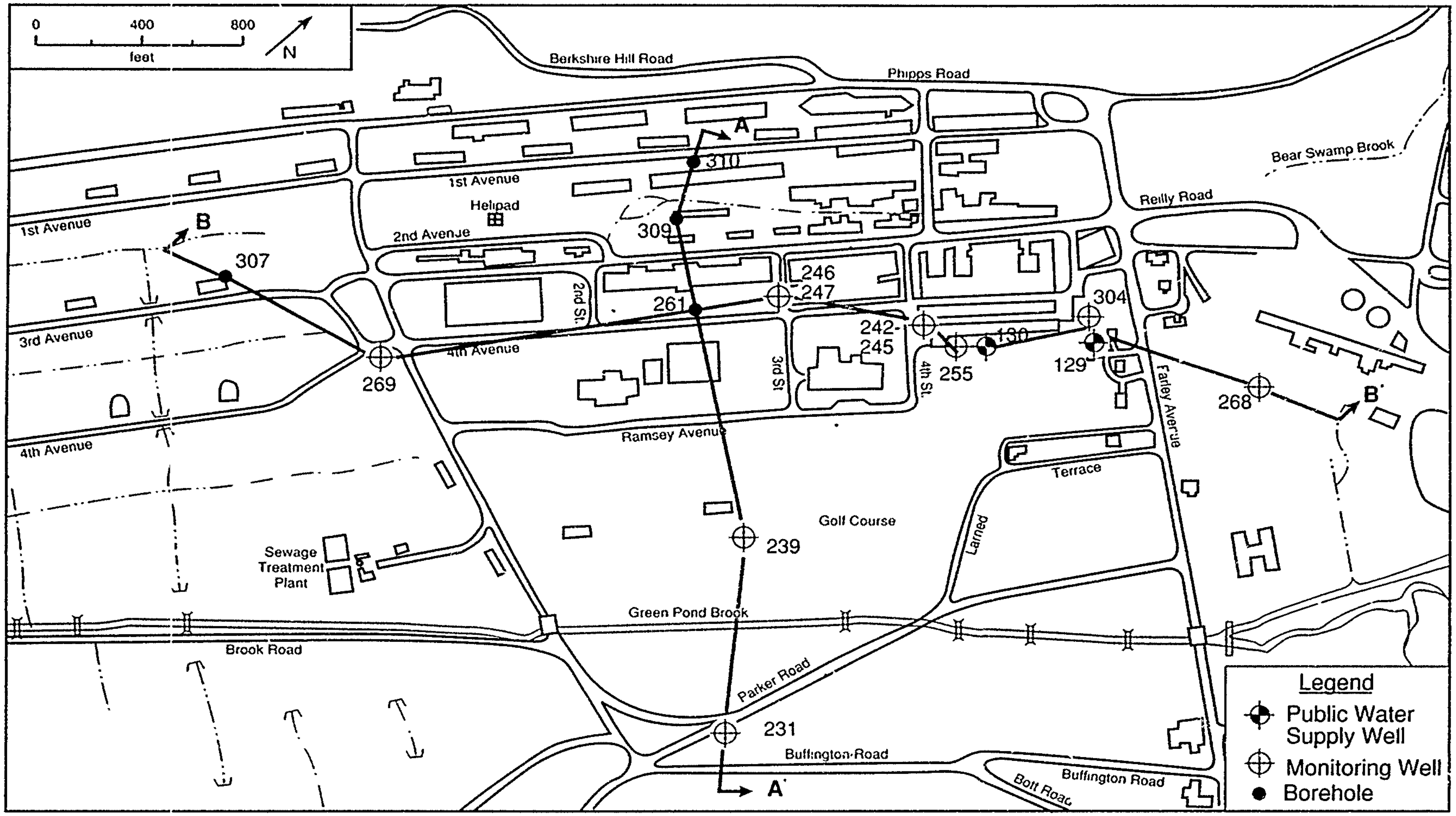

FIGURE 2.5 Locations of Hydrogeologic Sections A-A' and B-B' in the Central PTA Area (Source: Adapted from Vowinkel et al. 1985)

2.4 HYDROLOGY

2.4.1 Surface Water

Surface waters at PTA consist of lakes, ponds, reservoirs, enclosed basins, and drainageways (Fig. 2.6). The major surface drainage within PTA is from the northeast to southwest. The direction of flow is controlled by topographic elevations that border PTA on the east and west. A minor amount of the surface runoff flows in an easterly direction near building areas 3000 and 1500 and east of Lake Denmark Road. Although the annual precipitation is between 45 and 48 in., the annual runoff is about 25 in. (Wingfield 1976).

Two man-made lakes, Lake Denmark (174 acres, 331 million gal/d storage capacity) and Picatinny Lake (108 acres, 165 million gal/d storage capacity), are located within PTA. Lake Denmark is in the northern sector at an elevation of about 840 ft above MSL. The lake has a maximum length of 7,000 ft, with depths to 20 ft (Wingfield 1976). An extensive marsh borders the lake on the northeast. Both lakes are used for industrial water supply and recreation. A power generating station is located on the southwestern edge of Picatinny Lake (Vowinkel et al. 1985).

Picatinny Lake, located almost in the center of PTA, is elongate in shape with an overall length of over 1 mi, an average width of 1,000 ft, and a maximum depth of 20 ft (Wingfield 1976). Burnt Meadow Brook drains Lake Denmark and discharges into Green Pond Brook, which then flows into Picatinny Lake.

The major drainageways at PTA are Green Pond Brook and two of its tributaries, Burnt Meadow Brook and Bear Swamp Creek. Many small drainageways also occur throughout PTA. Green Pond Brook originates from Green Pond, north of the Arsenal; enters PTA 1.5 mi southeast of Green Pond; and flows southeasterly to the junction with Burnt Meadow Brook (Wingfield 1976). From this junction, Green Pond Brook flows southwest into Picatinny Lake; 3,400 ft south of the lake, the brook receives surface drainage originating at the intersection of Lake Denmark and Belt roads near the eastern boundary (Wingfield 1976). The elevation in the vicinity of this intersection is 900 ft above MSL (Wingfield 1976). After passing under First Street, Green Pond Brook flows through a large lowland (less than 700 ft above MSL) before exiting PTA at the southern boundary. Artificial drainage channels have been cut in the lowland. Green Pond Brook empties into the Rockaway River near the town of Wharton, about 1.5 mi southeast of PTA (Wingfield 1976).

Green Pond Brook flows through the center of PTA, and the terrain provides natural storm drainage for most of the developed areas; thus, relatively few storm sewers are required except in the comparatively flat southern part of PTA (Wingfield 1976).

Green Pond Brook is the outlet of Picatinny Lake and a tributary of Rockaway River (Vowinkel et al. 1985). The river discharges into the Boonton Reservoir, which is the source of water for Jersey City (Vowinkel et al. 1985). The reservoir at the rocket test area (Site 1) is also fed by two small brooks, which depend on natural drainage from

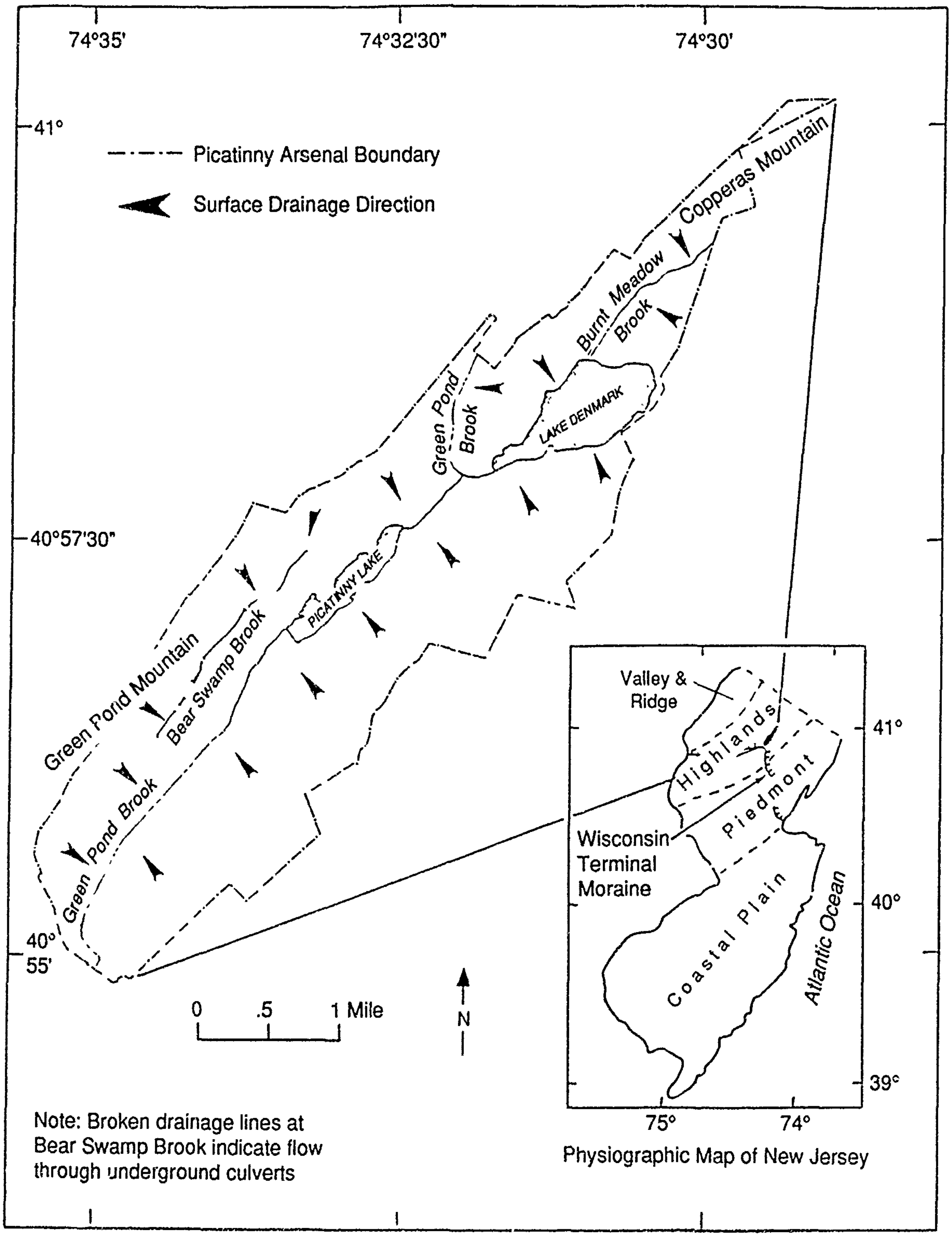

FIGURE 2.6 Surface-Water Drainage Patterns at Picatinny Arsenal (Source: Adapted from Sargent 1988)

the surrounding area (Wingfield 1976). There are two gaging stations on Green Pond Brook that have been in operation since November 1982. The mean daily discharges at the upper and lower gages were 38.4 and 68.2 ft^3/s, respectively, for the calendar years 1983 and 1984. Base flow discharge data collected on October 5, 1982, and September 10, 1984, indicate that Green Pond Brook is a gaining stream between the outlet at Picatinny Lake and the lower gaging station (Vowinkel et al. 1985).

Burnt Meadow Brook originates northeast of PTA, flows through a marsh near the base of Copperas Mountain, and discharges into Lake Denmark. Burnt Meadow Brook emerges from Lake Denmark and joins Green Pond Brook some 1,200 ft south of the lake (Wingfield 1976).

Several streams discharge into Green Pond Brook. The largest is Bear Swamp Brook, which originates from a spring near the top of Green Pond Mountain and flows through a series of culverts and underground piping systems before discharging into Green Pond Brook. Flow in Bear Swamp Brook is controlled by two weirs that create a pond where the stream makes a 90-degree bend in the direction of Green Pond Brook. To help control flooding, several drainage pipes discharge storm water into Bear Swamp Brook (Vowinkel et al. 1985). In addition, treated wastewater from Bldg. 24 was discharged into the brook. Base flow measurements indicate that the flow in Bear Swamp Brook is about 0.4 ft^3/s just downstream from Bldg. 24. Water levels and base flow measurements indicate that Bear Swamp Brook is a losing stream in the area of Bldg. 24.

2.4.2 Groundwater

Three principal aquifers have been identified at PTA: an unconfined stratified drift or water table aquifer, a confined glacial aquifer, and a bedrock aquifer. The water table aquifer occupies unconsolidated deltaic silts, clays, sands, and gravels at the surface. The confined glacial aquifer is made of sublacustrine sand and gravel, which is separated from the water table aquifer by the lake bottom fine sand and silt. The lake bottom fine sand and silt layer acts as a leaky confining bed. Groundwater movement in the bedrock aquifer depends on the secondary porosity provided by solution channels and fractures. The leaky confining beds are not continuous, and all the aquifers are interrelated and act as one system (Vowinkel et al. 1985). Table 2.3 summarizes hydrologic characteristics of northeastern glacial-aquifer systems.

The USGS performed a detailed evaluation of groundwater conditions in the areas of Bldgs. 24 and 95 in 1985 (Vowinkel et al. 1985). As seen in the hydrogeologic sections of the area (Figs. 2.5, 2.7, and 2.8), the top of the water-table aquifer generally lies within 15 ft of the ground surface and occupies the upper 35 ft of the valley (Vowinkel et al. 1985). The water-table aquifer is continuous throughout most of the central PTA area and is separated from the confined aquifer by a leaky confining bed up to 150 ft thick (Fig. 2.8) (Vowinkel et al. 1985). Northwest of Bldg. 24, another leaky clay bed about 5-15 ft thick is found at a depth of 5 ft (Vowinkel et al. 1985). Figure 2.9 shows the approximate areal extent of the clay bed.

Water-level fluctuations at selected water-table wells were measured in 1983 and 1984 by Vowinkel et al. (1985) near Bldgs. 24 and 95 in areas located in the general

TABLE 2.3 Selected Hydrologic Characteristics of Northeastern Glacial-Aquifer Systems

Characteristic	Range
Hydraulic conductivity	
Aquifer material	1-13,300 ft/d
Silt and clay	0.0001-1 ft/d
Till	0.00001-30 ft/d
Streambed material	0.03-120 ft/d
Fractured bedrock	<0.5-710 ft/d
Storage coefficient	
Confined sand and gravel	0.0001-0.01
Unconfined sand and gravel	0.05-0.35
Fractured bedrock	0.00001-0.12
Recharge from precipitation	0.2-31 in./yr
Groundwater evapotranspiration	1-9 in./yr

Sources: Lyford et al. 1983; Vowinkel et al. 1985.

direction of flow from Green Pond Mountain toward Green Pond Brook. The water levels indicate significant seasonal fluctuations and suggest changes in hydraulic gradient. The magnitude of the water-level fluctuations depends on the distance of the well from the mountain slope and from surface water bodies such as Green Pond Brook or swampy areas. Water levels in wells in the vicinity of Bldg. 24 showed greater seasonal fluctuations than those in wells near Bldg. 95. Wells along the perimeter of the valley compared with wells in the center of the valley have much larger water-level fluctuations after rainfall events, which recharge the wells from the mountains (Vowinkel et al. 1985).

Groundwater flow within the water table and confined glacial aquifers is essentially horizontal, moving east toward Green Pond Brook at an average velocity of 0.46-1.4 ft/d. Discontinuities in the confining silts and clays modify the flow path. Water levels taken in December 1987 and February 1988 show that the potentiometric surfaces of the confined glacial and bedrock aquifers are similar to the water-table aquifer in orientation. (See Sec. 23.2 in Volume 2 for more discussion on the potentiometric surfaces of the water table, confined glacial, and bedrock aquifers in the central valley area.)

The confining bed separating the water-table aquifer and the middle aquifer is not continuous and appears to be thinner and leakier between wells 129 and 130. The confining bed increases in thickness from well 129 to well 246, as the thickness of the confined glacial aquifer decreases. The confining bed becomes finer grained and less

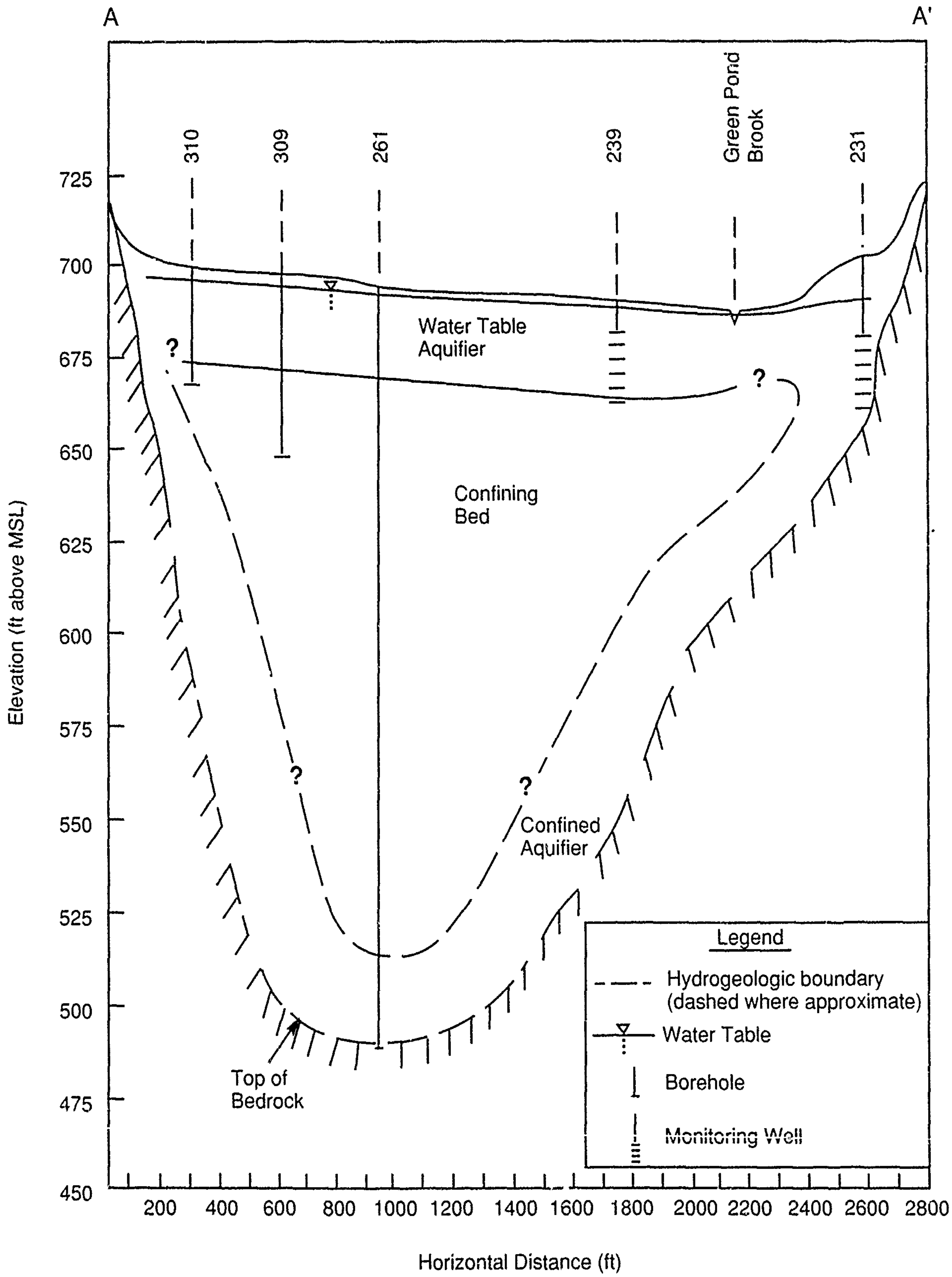

FIGURE 2.7 Generalized Hydrogeologic Section A-A' (Source: Adapted from Vowinkel et al. 1985)

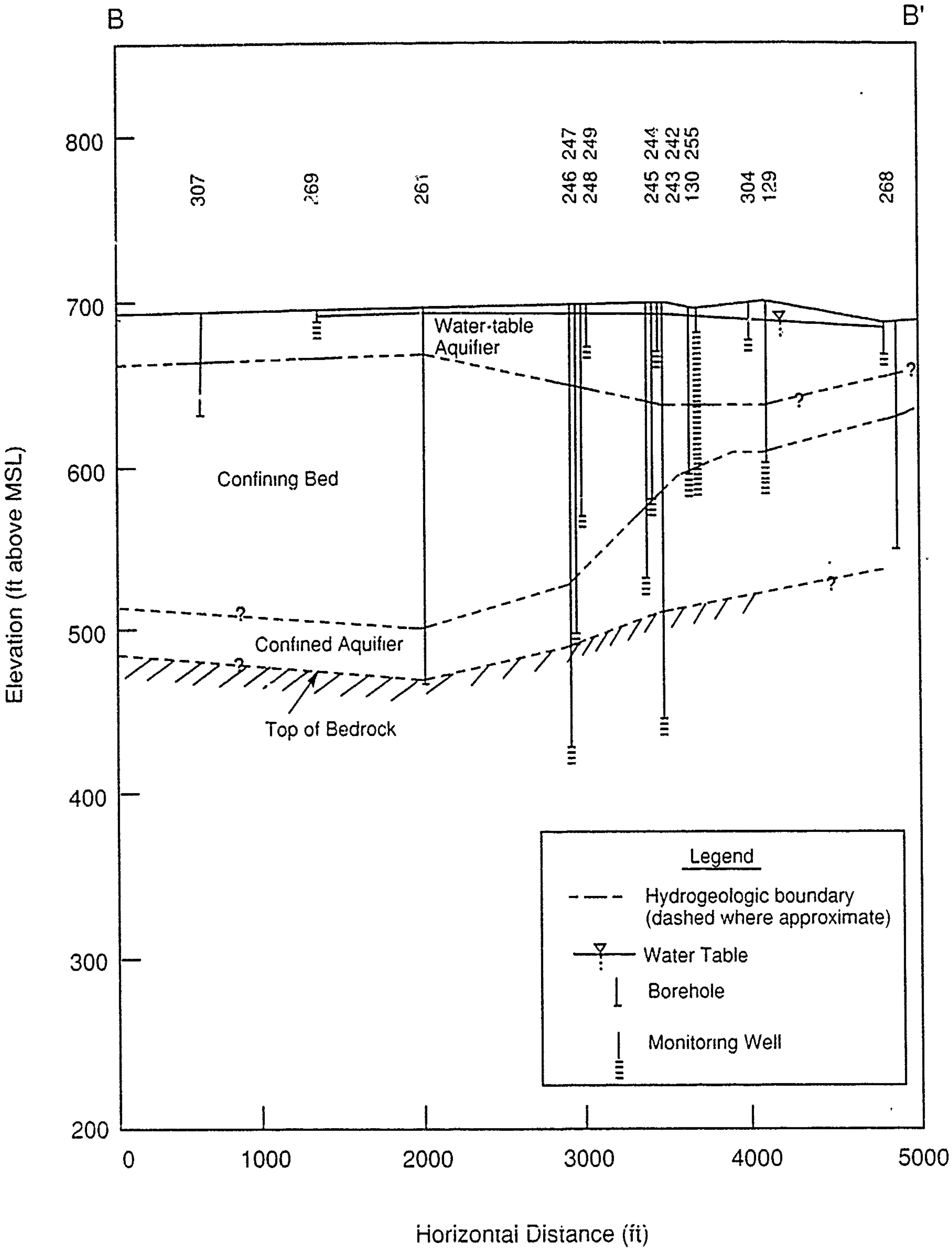

FIGURE 2.8 Generalized Hydrogeologic Section B-B' (Source: Adapted from Vowinkel et al. 1985)

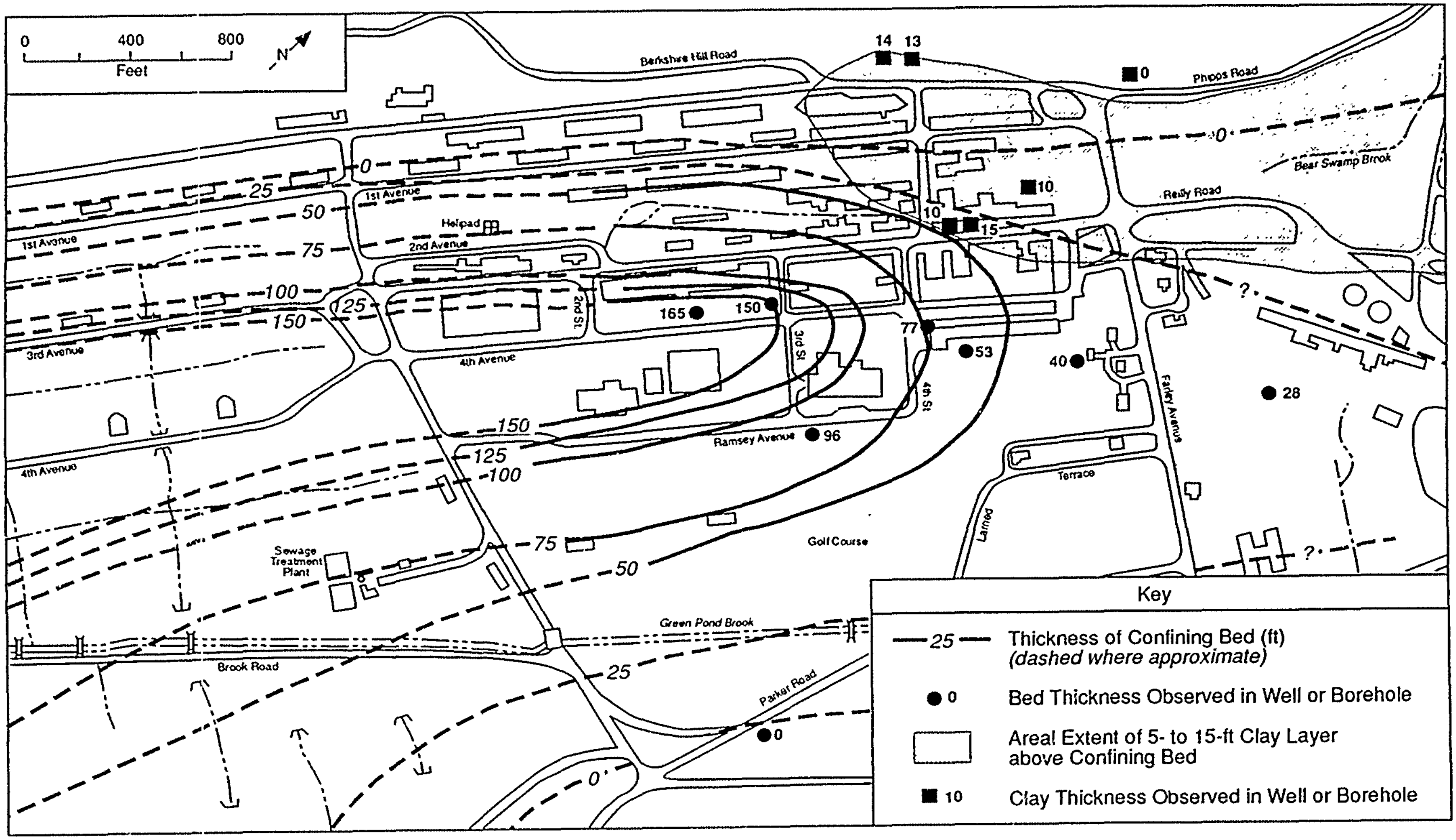

FIGURE 2.9 Thickness of the Confining Bed and Areal Extent of a Shallow 5- to 15-ft Clay Bed in the Central PTA Area (Source: Adapted from Vowinkel et al. 1985)

leaky toward the southwest. Analysis of a test hole and of aquifer test data indicate that the areal extent of the confining bed is limited (Vowinkel et al. 1985).

The confined glacial aquifer is the source of most PTA drinking water. Specific capacities of this aquifer vary depending on the location. Wells 129 and 130 are large-diameter wells with specific capacities of about 19 and 13 gal/min per foot of drawdown, respectively (Vowinkel et al. 1985). Aquifer tests indicate transmissivities in the confined aquifer range from about 7,600 ft^2/d at well 243 to 6,600 ft^2/d at well 130 (Vowinkel et al. 1985).

The detailed studies for the area of Bldgs. 24 and 95 generally reflect what is currently known about groundwater movement at the PTA. Vertical gradients in the unconsolidated deposits are generally downward on the sides of the valley and upward near Green Pond Brook. Minor flow variations appear to exist near Bear Swamp Brook, Robinson Run, and Ames Brook, but overall the flow is generally toward Green Pond Brook from both the east and west. Zones of the greatest vertical component of flow generally are upward, reflecting recharge from the hillsides. The range of measured head differences between the bedrock aquifer and the confined glacial aquifer is small, indicating that some limited flow exists between these aquifers (Sargent 1988).

Wells located outside PTA in the Rockaway River Basin are drawing from an unconsolidated Quaternary aquifer that has been designated a sole or principal source of drinking water for that area. It is currently unknown if the confined glacial aquifer at PTA is hydraulically interconnected to the Quaternary aquifer of the Rockaway River Basin.

Hydrographs show that water levels in all the aquifers are influenced by natural hydrologic changes and by pumping (Vowinkel et al. 1985). Measurements made in wells at the cafeteria well cluster, wells 242-245 (Fig. 2.5), showed that water levels in the confined glacial and bedrock aquifers are significantly affected by pumping, whereas water levels in the water-table aquifer are less affected (Vowinkel et al. 1985). Water levels are low in the fall and high in the spring. Under stressed conditions, the natural heads in the aquifer indicate a downward component from the water table to the confined aquifers, but the head difference is generally less than 2 ft. During stressed conditions, drawdown in the confined glacial aquifer is about 5 ft at well 244. At the same time, the drawdown at well 243 is less than 0.25 ft, increasing the hydraulic gradient to over 6 ft. As a result, flow from the water-table aquifer to the confined aquifer has increased significantly because of pumping (Vowinkel et al. 1985).

A weathered bedrock zone separates the confined glacial aquifer from the bedrock aquifer and acts as a leaking confining bed. The maximum known thickness of weathered bedrock is 60 ft in the central PTA area (Vowinkel et al. 1985). Within the bedrock aquifer, water is available from fractures and solution cavities that have been enlarged by weathering (Vowinkel et al. 1985). The bedrock aquifer beneath the study area can potentially supply moderate quantities of water.

2.5 ARSENAL ACTIVITIES

2.5.1 Introduction

The history of PTA shows that many types of activities were carried out over a long period of time. These activities have included production, research, and development of many kinds of munitions, propellants, and explosives. Along with these activities are various support activities such as land management, building and roads upkeep and management, and provision of medical and fire-fighting services.

These activities, going back more than 100 years, are expected to have had some impact on the environment by contaminating soil and water at various locations in and around the Arsenal. Information on the types and amounts of chemical and nuclear materials used at the arsenal in various periods and at different locations gives some indication of the types and amounts of expected contaminants.

Sources of historical information for PTA include production and use records, waste-generation records, inventories, permit applications, and records of interviews with Arsenal personnel. The following sections offer a brief description of the Arsenal history, a listing of some of the chemicals used at the Arsenal, and a discussion of the use of nuclear materials. The discussion here is general and applies to the Arsenal as a whole; in later sections, the discussions become Site-specific within the Arsenal.

2.5.2 History

Picatinny Arsenal was established as a powder works in 1880, with the purchase by the U.S. government of 1,866 acres in the Denmark and Middle Forge tracts for $62,750. The facility was designated the Dover Powder Depot for four days; on September 10, 1880, the name was changed to the U.S. Powder Depot. The final name change, to Picatinny Arsenal, occurred in October 1907 (War Plans Division 1931).

The first building erected at the Depot was a 200-ft by 50-ft magazine with a 6-ft basement. The building, which was completed in 1881, was designed to store black powder. The use of this building was part of the original purpose of the powder depot, which was the storage, preparation, and issue of powder, projectiles, and explosives. In 1891, 315 acres of the Arsenal was transferred to the U.S. Navy for the construction of magazines. In 1897, cartridge bag manufacture and loading of charges was begun at the Arsenal. The first production activity at Picatinny, propellant charge loading, began a few years before the Spanish American War with the assembly of powder charges for cannon. By 1900, the need for a storage area for armor-piercing projectiles and high explosives became evident. Six projectile sheds were erected in 1903, followed in 1904 by the construction of a plant for filling projectiles with Explosive "D" (ammonium picrate). In 1906, buildings and machinery for the capping, grooving, tapping, and banding of fixed ammunition were installed. A building constructed for assembly of fixed ammunition was used temporarily as a chemical laboratory and later as a high-explosives plant (War Plans Division 1931; USATHAMA 1976).

A factory for the manufacture of powder for large munitions began operations in January 1908. The capacity of the plant was 3,000 lb of cannon powder per 24-h working day. Later in 1908, the factory was expanded to include manufacture of 30-caliber small arms powder, creating an additional capacity of 250-300 lb of powder per day. In 1909, the capacity of the factory was increased to 9,000 lb of powder per day -- or about 2,750,000 lb per year. A new factory with a capacity of 1,000 lb of Explosive "D" per day was built in 1913. At the beginning of WWI, Picatinny was producing all sizes of propellants, from 30-caliber ammunition for rifles to 16-in. shells for coastal artillery guns (War Plans Division 1931; USATHAMA 1976).

During the Arsenal's early period of operation, other activities were started. In 1911, a school for training in interior ballistics, chemistry, and explosive was established. Chemical and physical laboratories for the testing and control of manufacturing processes and equipment research were established in conjunction with manufacturing operations (War Plans Division 1931).

Shortly before the U.S. entered WWI, manufacture of smokeless powder was increased at Picatinny. During that war, the need for considerable storage space for powder, explosives, and other components became evident. Accordingly, 54 magazines were constructed at the Arsenal. At the end of the war, the manufacture of smokeless powder at PTA was discontinued because of the large quantities of powder on hand. New operations included the melt-loading of projectiles and the manufacture of pyrotechnic signals and flares. Plants were also built for the experimental manufacture of modern propellants, high explosives, fuzes, and metal components. This activity included the study of raw materials, military pyrotechnics, and trench warfare materials; a plant for loading trinitrotoluene (TNT), and amatol into bombs and projectiles was also established. In 1921, the Arsenal took over all experimental work on fuses (War Plans Division 1931; USATHAMA 1976).

During a thunderstorm on Saturday afternoon, July 10, 1926, at about 5:15 PM, lightning struck in the Lake Denmark Naval Depot at or near a magazine containing more than 1,000,000 lb of cast TNT. A fire started in the magazine, which detonated about five minutes later. An adjoining magazine blew up five minutes later, blowing steel girders 5,000 ft away and wooden beams to a reported distance of up to 3.5 mi. A third explosion occurred at 5:45 PM with the detonation of a shellhouse. These explosions created three large craters, started many fires in other magazines and buildings, and destroyed many of the buildings at Picatinny. Eighteen people were killed. The total amount of explosives detonated in the three explosions was about 2,400,000 lb (War Plans Division 1931; Hatcher 1962).

Following the explosion, the Arsenal was rapidly cleaned up and rebuilt. In 1931, Picatinny Arsenal was the U.S. Army Ammunition Arsenal for the loading of bombs and projectiles, the manufacture and loading of all types of pyrotechnics and smokeless powder, the assembly of all fixed ammunition larger then 50 caliber, and the performance of chemical laboratory services for the ordnance department (War Plans Division 1931).

Before WWII, most of the pilot plant operations at Picatinny were enlarged to assembly line production. At the time of the Japanese attack on Pearl Harbor, PTA was the only facility in the United States capable of making large amounts of ordnance needed for the war. During the war, PTA production activities employed 7,000 personnel around the clock seven days a week. Large amounts of many different types of munitions and explosives were produced during the war, as shown in Table 2.4, which gives the amount of explosives produced in 1943, 1944, and later years (USATHAMA 1976; Gaven 1986, Attachment W [dated 1982]).

During the Korean War, the Arsenal employed 3,000 personnel. Large amounts of explosives (Table 2.4) were produced for the war effort. Some production of war materiel was carried out during the years between the Korean and Vietnamese wars. Production records for the calendar years 1957 to 1959 list many types of mines, shells, fuses, high-explosive castings and rockets, flash smokeheads for rockets, wafer bombs, and JATO units. Some nitroglycerin was also produced (Table 2.4). The Arsenal contributed to the development of some nuclear weapons such as artillery shells and the Davy Crockett in the 1950s. Design and development work on warheads for several army missiles such as the Nike family, the Hawk, Redstone, Corporal, Sergeant, Littlejohn, Honest John, SAM-D, Lance, and Safeguard was carried out at the Arsenal (USATHAMA 1976; Gaven 1986, Attachments A and W).

During the Vietnam War, production of nitroglycerin continued, as did the use of loading facilities that were essential for pilot plant production. The Arsenal contributed to the war by the development of Beehive ammunition of different calibers, mines that were dispersed from low-flying helicopters, and unique explosive systems for destroying tunnel networks. At the present time, research and development work on both nuclear and nonnuclear weapons is continuing at the Arsenal. The R&D applications include artillery, infantry, vehicle and aircraft weapons; demolition munitions; mines; bombs; grenades; pyrotechnic systems; rocket-assisted projectiles; flares; chemical systems/materials; and fuses (USATHAMA 1976; Foster Wheeler 1987a, Attachments A and W).

2.5.3 Chemicals Used at the Picatinny Arsenal

An exhaustive listing of all the chemicals used at the Arsenal throughout the 100-year period of active operations is impossible because appropriate records are not available for most of the years of operations. However, it is probably a reasonable assumption that a listing of chemicals used in recent years of operation includes most of the chemicals used in earlier operations. The pattern of growth and expansion in the chemical industry suggests that many chemicals used in earlier years were also used in recent operations. Also, the shift in emphasis at Picatinny from production to research and development in recent years implies that more types of chemicals would be used (in smaller amounts) than were used in the earlier production phase.

Lists of some of the chemicals used at PTA is given in App. A. The list has been generated from several sources such as pesticide inventories, hazardous-waste listings, recorded interviews with Picatinny personnel, information on production processes for explosives, and supporting documents for RCRA permit applications.

TABLE 2.4 Annual Amounts of Explosives Produced at Picatinny Arsenal from 1943 to 1970 (lb/yr)[a]

Explosive Materials[b]	1943	1944	1949	1950	1951	1952	1953	1954	1955
Smokeless powder	7,920,000	6,150,000		1,100,000	40,000	28,089			
Tetryl	1,536,000	1,080,000							
EDNA	12,000	10,000							
Boosters	2,820,000	1,400,000							
Primers	7,430,000	5,250,000							
Detonators	25,550,000	11,609,000							
Demolition blocks				10,000					
C-4 composition				800,000	600,000				
T-9 composition			1,900,000	1,720,000					
Igniters M-20			300,000	180,000	1,320,000	1,200,000			
60-mm mortar prop. powder					120,000	120,000			
Solvent powder							140,000	138,000	240,000
Nitroglycerin					78,000	80,000	75,000	82,000	100,000
Solventless powder									1,800,000
Other H.E.					6,400	6,200	143,000	246,000	2,040,000
P & E misc.									28,000

	1956	1957	1958	1959-60	1961-62	1963-64	1965-66	1968-70
Nitroglycerin	98,000	102,000	95,000	90,000	92,000	95,000	88,000	80,000

[a]No production reported for 1945-1948.

[b]Only nitroglycerin produced during the period 1956 through 1970.

Source: USATHAMA 1976.

2.5.4 Radioactive Materials at Picatinny Arsenal

Since the 1950s, research and development of nuclear weapons and other uses of radioactive materials have been carried out at several locations at PTA. In the past, some nuclear weapons components have also been manufactured at the Arsenal. Building 95 has been used for the manufacture of adaption kits for nuclear weapons components, and Bldg. 60 was the adaption kit laboratory. Effluent from etching and plating operations needed in the manufacture of nuclear weapons components was treated and discharged into a nearby stream. Cooling water was required for the operations carried out in Bldg. 60, which included the use of depleted uranium (DU) (USATHAMA 1976).

The Radiation Research Laboratory in Bldg. 3021 contains much of the radioactive material used at the arsenal. Materials stored or used there include several hundred curies (Ci) of tritium (H-3); more than 10,000 Ci of Co-60; several hundred pounds of U-238; curie amounts of Cs-137, Cf-252, and Pu-238; and smaller amounts of other radioactive materials. Other buildings containing multicurie amounts of radioactive materials include Bldg. 320 (H-3), Bldg. 64 (Pu-238), Bldg. 908 (Cf, Co-60), Bldg. 60 (H-3), Bldg. 3030 (H-3), Bldg. 221 (Co-60), Bldg. 620, (Cs-137), Bldg. 18 (H-3), and Bldg. 1090 (Co-60). Depleted uranium (DU or U-238) was used at many locations at the Arsenal. Uses included firing and detonation of DU-containing munitions; machining of DU-containing items; and research into mechanical, thermal, and corrosion properties of DU. A more complete list of past and present locations, uses, and quantities of radioactive materials used at PTA is given in App. B (USATHAMA 1976; Duncan 1990).

Much of the radioactive material is contained in sealed sources and containers. Some is kept in unsealed containers. All incoming shipments of radioactive material are received at the Bldg. 91 warehouse. Unwanted radioactive materials are sent to Bldg. 3018, sealed in drums, and removed in accordance with regulation AR 755-15 and 10 CFR 20. Radioactive waste is disposed of in compliance with Nuclear Regulatory Commission rules and regulations by the U.S. Army Materiel Command's central disposal authority, U.S. Army Armament, Munitions, and Chemical Command. Storage of radioactive waste in containers in a secure area of Bldg. 3021 and in Bldg. 84 was reported in a 1976 survey. There are no reported instances of radioactive material disposal on the Arsenal (USATHAMA 1976; USAEHA 1977; Ward 1988). Personnel from the PTA Safety Office reported during interviews in July 1976 that Bldg. 3018, which contains radwaste, and Bldg. 514, in which radwork occurred previously, may be contaminated (Gross et al. 1976).

Radioactive parameters proposed for analysis in the RI sampling plans include uranium at a few Sites where DU was used and gross alpha and gross beta at Sites for which there is a potential for radioactive contamination. Sites that show one or more samples with elevated gross alpha or gross beta contamination would require further analysis to determine which radionuclides are causing the contamination.

3 REGULATORY ASPECTS

3.1 BACKGROUND

The legal basis for applying both federal and state requirements or standards to remedial actions at federal facilities such as the Picatinny Arsenal resides in Secs. 120 and 121(d) of CERCLA, as amended by SARA. These sections require that remedial actions at federal facilities satisfy applicable or relevant and appropriate requirements (ARARs). For water, the ARARs are to be applied under the Safe Drinking Water Act (SDWA), Clean Water Act, and RCRA. For surface water or groundwater that is or may be used for drinking, the relevant and appropriate federal cleanup standards are the maximum contaminant levels (MCLs). If MCLs are not available for the chemical contaminants under consideration, then the EPA recommends use of the human health advisory levels. The EPA has determined that promulgated state cleanup standards are included in SARA as ARARs, even if they are more stringent than the federal standards (EPA 1987c).

Remedial actions at federal facilities are also covered by RCRA and HSWA. Sections 3004(u), 3004(v), and 3008(h) of HSWA give the EPA additional authority, beyond that provided by the RCRA, in carrying out corrective action programs. These programs apply to all closed, closing, or operating RCRA facilities. Also, the authority of the EPA to require corrective action for releases of hazardous constituents applies not only to groundwater releases from permitted units; its authority was extended to cover releases from all units to all environmental media. The current regulatory climate also encourages the use of other laws to obtain corrective action at federal facilities.

Sections 3004(u), 3004(v), and 3008(h) change the emphasis of the RCRA corrective action program from detection and correction of future releases from regulated units to cleanup problems resulting from past waste-management practices at RCRA facilities. Section 3004(u) stipulates that any permit issued after November 8, 1984, requires corrective actions for all releases from solid-waste management units at a facility. It also allows compliance schedules to be included in permits where corrective action cannot be finished before the permit is issued. Section 3004(v) directs the EPA to issue regulations requiring corrective action beyond a facility's boundaries whenever needed to protect human health and the environment. The necessary corrective action can be required before the regulations are promulgated. Section 3008(h) gives the EPA authority to issue enforcement orders to require corrective action or other response measures at interim status facilities (EPA 1986d).

Additional potentially relevant aspects of the HSWA and SARA are discussed, respectively, in Secs. 3.4 and 3.5 of this report. New Jersey soil action levels are discussed in Sec. 3.6.

3.2 WATER QUALITY CRITERIA

3.2.1 Federal

Table 3.1 gives the federal ambient water quality criteria for various chemicals. Sources for the table entries include EPA (1985, 1989) and 40 CFR 141. Some of the MCLs are included in the national primary drinking water standards (40 CFR 141), which are enforceable federal standards that are applicable to remedial action alternatives. Others are proposed or recommended values.

Recommended values that are not legally enforceable should also be considered in an analysis of remedial action alternatives. This includes the maximum contaminant level goals (MCLGs), which are included in SARA as potential ARARs. MCLGs are set at levels that cause no known or anticipated adverse health effects and allow for an adequate safety margin (EPA 1989). The MCLG is zero for all carcinogens. The Clean Water Act water quality criteria, which are also included in SARA as potential ARARs, are given for toxic effects and for carcinogenicity at a 10^{-6} lifetime-risk level. Criteria for different risk levels can be obtained as described in footnote e to Table 3.1. Organoleptic criteria are based on odor or taste, not on any health-based criteria. The 10-day and chronic health advisory criteria refer to exposure for a period of 10 days and continuous exposure, respectively.

The MCL values in Table 3.1 are supplied for only a few of the chemicals listed. This situation is expected to change in the next few years because amendments to the SDWA require that the EPA set MCL and MCLG values for 83 contaminants by June 1989. MCL values have been given (40 CFR 141) for some radionuclides, which were included in the list of 83 contaminants (EPA 1986b).

3.2.2 State of New Jersey

3.2.2.1 Drinking Water

New Jersey has adopted the Federal National Primary Drinking Water regulations (given in the most current version of 40 CFR 141) as the New Jersey Primary and Secondary Drinking Water regulations. The adoption includes all requirements concerning siting, MCLs, monitoring, chemical analysis, reporting, public notification, and record keeping (New Jersey Administrative Code [NJAC] 7:10-5.1). MCLs for New Jersey are given separately in Table 3.2, as some of the regulated parameters and values are different from federal ones.

The national regulations allow the states discretionary authority to make certain changes in the regulations. Accordingly, New Jersey may allow a monthly average turbidity standard in MCL of up to 5 units at an entry to a water distribution system (a turbidity exception). The state also requires noncommunity water systems to perform nitrate measurements every three years or less. Community water systems (systems that serve at least 15 service connections that are used all year or serve at least 25 residents all year) using surface water sources must measure organic components every three years

TABLE 3.1 Federal Ambient Water Quality Standards (μg/L except as noted otherwise) Based on Regulations and Other Criteria[a]

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Health Advisories: 10-Day	Safe Drinking Water Act: Health Advisories: Chronic	Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d]	Human Health: Toxic Effect	Human Health: Carcinogen[e] (10^{-6} risk)	Organoleptic[f]
Acenaphthene	-	-	-	-	-	-	20
Acrolein	-	-	-	-	-	-	540
Acrylonitrile	-	-	-	0	-	0.063	-
Aldrin	-	-	-	0	-	0.0012	-
Antimony	-	-	-	-	146	-	-
Arsenic	50	-	-	0	-	0.0025	-
Asbestos	-	-	-	0	-	30,000 fibers/L	-
Barium	1,000	-	-	5,000[g]	-	-	-
Benzene	5	230	70	0	-	0.67	-
Benzidine	-	-	-	0	-	0.00015	-
Beryllium	-	-	-	0	-	0.0039	-
Cadmium	10	-	-	5[g]	10	-	-
Carbon tetrachloride	5	-	-	0	-	0.42	-
Chlordane	2[g]	62.5	7.5	0	-	0.022	-
Chlorinated benzenes							
Hexachlorobenzene	-	-	-	0	-	0.021	-
1,2,4,5-Tetrachlorobenzene	-	-	-	-	180	-	-
Pentachlorobenzene	-	-	-	-	570	-	-
o-Dichlorobenzene	600[g]	-	-	600[g]	-	-	-
p-Dichlorobenzene	75	-	-	75[k]	-	-	-
Monochlorobenzene	-	-	-	100[g]	488	-	-
Chlorinated ethanes							
1,2-Dichloroethane	5	-	-	0	-	0.94	-
1,1,1-Trichloroethane	200	-	1,000	200	19,000	-	-
1,1,2-Trichloroethane	-	-	-	0	-	0.6	-
1,1,2,2-Tetrachloroethane	-	-	-	0	-	0.17	-
Hexachloroethane	-	-	-	0	-	2.4	-
Chlorinated phenols							
3-Chlorophenol	-	-	-	-	-	-	0.1

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Health Advisories, 10-Day	Safe Drinking Water Act: Health Advisories, Chronic	Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d]	Human Health: Toxic Effect	Human Health: Carcinogen[e] (10^{-6} risk)	Organoleptic[f]
Chlorinated phenols (cont'd)							
4-Chlorophenol	-	-	-	-	-	-	0.1
2,3-Dichlorophenol	-	-	-	-	-	-	0.04
2,5-Dichlorophenol	-	-	-	-	-	-	0.5
2-Chlorophenol	-	-	-	-	-	-	0.1
2,4-Dichlorophenol	-	-	-	-	3.09	-	-
2,6-Dichlorophenol	-	-	-	-	-	-	0.2
3,4-Dichlorophenol	-	-	-	-	-	-	0.3
2,3,4,6-Tetrachlorophenol	-	-	-	-	-	-	1
2,4,5-Trichlorophenol	-	-	-	-	2,600	-	-
2,4,6-Trichlorophenol	-	-	-	0	-	1.8	-
2-Methyl-4-chlorophenol	-	-	-	-	-	-	1,800
3-Methyl-4-chlorophenol	-	-	-	-	-	-	3,000
3-Methyl-6-chlorophenol	-	-	-	-	-	-	20
1,2-Dichloropropane	-	-	-	0[g]	-	-	-
Chlorophenoxys							
2,4-Dichlorophenoxyacetic acid (2,4-D)	100	-	-	70[g]	-	-	-
2,4,5-Trichlorophenoxy-propionic acid (2,4,5-T)	10	-	-	52[g]	-	-	-
Chloroalkyl ethers							
bis(Chloromethyl) ether	-	-	-	0	-	3.9×10^{-6}	-
bis(2-Chloroethyl) ether	-	-	-	0	-	0.030	-
bis(2-Chloroisopropyl) ether	-	-	-	-	34.7	-	-
Chloroform	100[h]	-	-	0	-	0.19	-
Chromium (VI)	50	-	-	-	50	-	-
Chromium (III)	-	-	-	-	179,000	-	-
Copper	-	-	-	-	-	-	1,000
Cyanide	-	-	-	200	-	-	-
DDT	-	-	-	0	-	>0.0012	-
Dibromochloropropane	0.2[g]	-	-	0[g]	-	-	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Health Advisories: 10-Day	Safe Drinking Water Act: Health Advisories: Chronic	Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d]	Clean Water Act, Water Quality Criteria[c]: Human Health: Toxic Effect	Clean Water Act, Water Quality Criteria[c]: Human Health: Carcinogen[e] (10^{-6} risk)	Clean Water Act, Water Quality Criteria[c]: Organoleptic[f]
Dichlorobenzenes	-	-	-	470	-	-	-
Dichlorobenzidines	-	-	-	0	-	0.0207	-
1,1-Dichloroethylene	7	-	70	7[k]	-	0.033	-
1,2-Dichloroethylene (cis)	70[k]	400	-	70[g]	-	-	-
1,2-Dichloroethylene (trans)	100[g]	270	-	100[g]	-	-	-
Dichloromethane	i	1,300	150	i	i	i	-
Dichloropropylenes	-	-	-	-	87	-	-
Dieldrin	-	-	-	0	-	0.0011	-
2,4-Dimethylphenol	-	-	-	-	-	-	400
2,4-Dinitrotoluene	-	-	-	0	-	0.16[j]	-
2,6-Dinitrotoluene	-	-	-	0	-	j	-
p-Dioxane	-	568	-	-	-	-	-
1,2-Diphenylhydrazine	-	-	-	0	-	0.046	-
Endosulfan	-	-	-	-	138	-	-
Endrin	0.2	-	-	-	1	-	-
Ethylbenzene	-	-	-	700[g]	2,400	-	-
Ethylene dibromide	0.05[g]	-	-	0	-	-	-
Ethylene glycol	-	-	5,500	-	-	-	-
Formaldehyde	-	30	-	-	30	-	-
Fluoranthene	-	-	-	188	-	-	-
Fluoride	4	-	-	4[k]	-	-	-
Halomethanes	-	-	-	0	-	0.19	-
Heptachlor	0.4[g]	-	-	0	-	0.011	-
Hexachlorobutadiene	-	-	-	0	-	0.45	-
Hexachlorocyclohexanes							
α-Hexachlorocyclohexane	-	-	-	0	-	0.013	-
β-Hexachlorocyclohexane	-	-	-	0	-	0.0232	-
γ-Hexachlorocyclohexane (lindane)	4	-	-	0.2[g]	-	0.0264	-
Hexachlorocyclopentadiene	-	-	-	-	206	-	-
n-Hexane	-	4,000	-	-	-	-	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act			Clean Water Act, Water Quality Criteria[c]			
	Maximum Contaminant Level[b]	Health Advisories		Maximum Contaminant Level Goal[d]	Human Health		Organoleptic[f]
		10-Day	Chronic		Toxic Effect	Carcinogen[e] (10^{-6} risk)	
Isophorone	-	-	-	-	5,200	-	-
Kerosene/fuel oil No. 2	-	350[l]	-	-	-	-	-
Lead	50	-	-	20[g]	50	-	-
Mercury	2	-	-	2[g]	10	-	-
Methoxychlor	400[g]	-	-	400[g]	-	-	-
Methyl ethyl ketone	-	7,500	750	-	-	-	-
Nickel	-	-	-	-	15.4	-	-
Nitrate, as N	10,000	-	-	10,000[g]	-	-	-
Nitrite, as N	1,000[g]	-	-	1,000[g]	-	-	-
Nitrobenzene	-	-	-	-	19,800	-	-
Nitrophenols							
2,4-Dinitro-o-cresol	-	-	-	-	13.6	-	-
Dinitrophenol	-	-	-	-	70	-	-
Nitrosamines							
N-Nitrosodimethylamine	-	-	-	0	-	0.0014	-
N-Nitrosodiethylamine	-	-	-	0	-	0.0008	-
N-Nitrosodi-n-butylamine	-	-	-	0	-	0.0064	-
N-Nitrosodiphenylamine	-	-	-	0	-	7.0	-
N-Nitrosopyrrolidine	-	-	-	0	-	0.016	-
Pentachlorophenol	200[g]	-	-	200[g]	1,010	-	-
Phenol	-	-	-	-	3,500	-	-
Phthalate esters							
Dimethyl phthalate	-	-	-	-	350,000	-	-
Diethyl phthalate	-	-	-	-	434,000	-	-
Dibutyl phthalate	-	-	-	-	44,000	-	-
bis(2-Ethylhexyl) phthalate	-	-	-	-	21,000	-	-
Polychlorinated biphenyls (PCBs)	0.5[g]	12.5	-	0	-	>0.0126	-
Polynuclear aromatic hydrocarbons	-	-	-	0	-	0.0031	-
RDX	-	-	-	-	33.7[m]	-	-
Selenium	10	-	-	50[g]	10	-	-

TABLE 3.1 (Cont'd)

Chemical	Safe Drinking Water Act: Maximum Contaminant Level[b]	Safe Drinking Water Act: Health Advisories, 10-Day	Safe Drinking Water Act: Health Advisories, Chronic	Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d]	Human Health: Toxic Effect	Human Health: Carcinogen[e] (10^{-6} risk)	Organoleptic[f]
Silver	50	-	-	-	50	-	-
2,3,7,8-TCDD (dioxin)	-	-	-	0	-	1.8×10^{-7}	-
Tetrachloroethylene	5[g]	175	20	0	-	0.88	-
Thallium	-	-	-	-	17.8	-	-
Toluene	2,000[g]	2,200	340	2,000[g]	15,000	-	-
Toxaphene	5	-	-	0	-	25,800	-
Trichloroethylene	5	200	75	0	-	2.8	-
Trihalomethanes	100[h]	-	-	-	-	-	-
Trinitroglycerin	-	-	-	-	-	1.4[n]	-
Trinitrotoluene (TNT)	-	-	-	-	44[m]	-	-
Vinyl chloride	2	-	-	0	-	2	-
Xylenes	10,000[g]	1,200	620	10,000[g]	-	-	-
Zinc	-	-	-	-	-	-	5,000

[a]Sources: EPA 1985, EPA 1989, and 40 CFR 141, unless otherwise noted. A hyphen denotes the absence of a regulation or criterion.

[b]These standards are part of the national primary drinking water regulations (40 CFR 141).

[c]These criteria are recommended but not legally enforceable.

[d]MCLGs are nonenforceable health goals that are set at a level at which no known or anticipated adverse health effect occurs and that allows an adequate safety margin. The MCLG for all carcinogens is zero.

[e]To obtain criteria for risks at 10^{-4}, 10^{-5}, and 10^{-7}, multiply the criteria by factors of 100, 10, and 0.1, respectively. Values are for ingestion of water only and do not include ingestion of fish.

[f]Organoleptic criteria are based on odor and taste; health-based criteria are not available.

TABLE 3.1 (Cont'd)

[g]Proposed value (see EPA 1989).

[h]The summed concentration of the four trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) must be less than 100 µg/L.

[i]See halomethane criteria.

[j]Source: Etnier 1987. Insufficient data are available to estimate a water quality criterion for 2,6-DNT. However, existing data show that this isomer is a more potent carcinogen than the 2,4 isomer.

[k]Values given in the National Primary Drinking Water regulations, 40 CFR 141.

[l]Seven-day health advisory for benzene and benzo(a)pyrene in kerosene, respectively.

[m]Source: Erickson 1980.

[n]Source: Smith 1986.

TABLE 3.2 Drinking Water MCLs for the State of New Jersey[a]

Chemical	MCL (µg/L)
Arsenic	50
Barium	1,000
Benzene	1
Cadmium	10
Carbon tetrachloride	2
Chlordane	0.5
Chlorobenzene	4
Chromium (hexavalent)	50
m-Dichlorobenzene	600
o-Dichlorobenzene	600
p-Dichlorobenzene	6
1,2-Dichloroethane	2
1,1-Dichloroethylene	2
1,2-Dichloroethylene (trans)	10
2,4-D	100
Endrin	0.2
Lead	50
Lindane	4
Mercury	2
Methoxychlor	100
Methylene chloride	2
Nickel	13.4
Nitrate (as N)	10,000
PCBs	0.5
Selenium	10
Silver	50
2,4,5-TP (Silvex)	10
Tetrachloroethylene	1
Toxaphene	5
Trichlorobenzene	8
1,1,1-Trichloroethane	26
Trichloroethylene	1
Vinyl chloride	2
Zinc	44

[a]NJAC 7:10-16.7a; New Jersey Safe Drinking Water Act and A-280 Amendments.

Source: Adapted from York 1990a.

or more often. Other state requirements are given in the New Jersey Administrative Code (NJAC 7:10-5.2).

Secondary drinking water regulations apply to any substance in drinking water that may adversely affect the taste, odor, or appearance of water or that may adversely affect the public welfare. The state secondary drinking water regulations are given in Table 3.3. The listed concentrations apply to water at the free-flowing outlet of the ultimate user of a public or nonpublic water system (NJAC 7:10-7.1). The recommended upper limits in the table are values that should not be exceeded. The recommended lower limits are concentration levels that should be equaled or exceeded (NJAC 7:10-7.2).

TABLE 3.3 New Jersey Secondary Drinking Water Standards

Parameter	Recommended Upper Limit	Recommended Lower Limit
Color	10 color units	-[a]
Corrosivity	Within ±1.0 of optimum pH	-
Odor	3 (threshold odor number)	-
Taste	No objectionable taste	-
ABS/LAS[b]	0.5 mg/L	-
Chloride	250 mg/L	-
Copper	1.0 mg/L	-
Fluoride[c]	-	1.0 mg/L
Hardness, as $CaCO_3$	250 mg/L	50 mg/L
Iron	0.3 mg/L	-
Manganese[d]	0.05 mg/L	-
Sodium[e]	50 mg/L	-
Sulfate	250 mg/L	-
Total dissolved solids	500 mg/L	-
Zinc	5.0 mg/L	-

[a]No value given.

[b]Alkyl-benzene-sulfonate and linear-alkyl-sulfonate, or similar methylene-blue reactive substances contained in synthetic detergents.

[c]An MCL for fluoride is included in the state primary drinking water regulations. The recommended lower limit applies only to those water supplies in which the fluoride concentration is artificially adjusted.

[d]The limits for iron and manganese may be raised to 0.6 mg/L and 0.1 mg/L, respectively, if a sequestering treatment is provided. Whenever either of these limits is exceeded in the raw water of a public community water system, the water must be treated to reduce the concentrations to below 0.3 mg/L (iron) and 0.05 mg/L (manganese).

[e]Significant only for consumers requiring a low-sodium diet.

3.2.2.2 Surface Water

The state of New Jersey has promulgated surface water quality standards for several types of surface waters. For FW2 waters,* which appear to be the type in the lakes and streams on the PTA grounds, the standards are expressed as concentration levels in the receiving waters that must not be exceeded as a result of any discharge into the waters (water-quality-based effluent limitations). The surface water quality standards for FW2 waters are given in Table 3.4. For any parameter for which the quality in the receiving surface water is below that in the table because of natural causes, the background value is to be used as the standard (NJAC 7:9-4.1 through 7:9-4.14).

Some concentration limits apply to surface water discharges that are allowed by a New Jersey Pollutant Discharge Elimination System (NJPDES) permit when the discharges come from a manufacturing or research facility. In essence, the NJDEP must be notified if discharges occur or will occur that would result in the release of toxic pollutants not specifically covered in the permit at concentrations of 100 μg/L or more. Some specific pollutants have higher notification limits: 200 μg/L for acrolein and acrylonitrile; 500 μg/L for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and 1 mg/L for antimony (NJAC 7:14A-3.11 as reported in Bureau of National Affairs 1988).

3.2.2.3 Groundwater

The state of New Jersey has also promulgated groundwater quality standards for protection of different types of groundwater. For types GW2 and GW3‡ groundwater, the state has established criteria that must not be exceeded by human activities. If discharges to groundwater result in the criteria being exceeded, the NJDEP may require dischargers to restore and upgrade the groundwater or contain the contamination within boundaries established by the NJDEP (NJAC 7:9-6.5).

Groundwater quality criteria for GW2 and GW3 waters are given in Table 3.5. The primary standards cannot be exceeded except as a result of natural conditions. The NJDEP may establish conditions in a permit that allow the secondary standards to be exceeded only if there is no adverse effect on the designated uses of the groundwater (NJAC 7:9-6.6).

*FW2 waters are general surface waters not designated as FW1 or Pinelands waters. FW1 waters are waters that originate in and are wholly contained in federal or state parks, forests, fish and wildlife lands, and other holdings; they are maintained in their natural state and are not subject to man-made discharges. Pinelands waters are all non-FW1 waters within the Pinelands Area (NJAC 7:9-4.4).

‡Class GW2 groundwater contains a natural total dissolved solids (TDS) concentration of less than 500 mg/L. It is suitable for potable, industrial, or agricultural water supply after conventional water treatment, if necessary, or for surface water replenishment. GW3 groundwater has a natural TDS concentration between 500 and 10,000 mg/L. It is suitable for conversion to fresh potable water or other beneficial uses (NJAC 7:9-6.5)

TABLE 3.4 Surface Water Quality Criteria for FW2 Waters[a]

Parameter	Criteria
Fecal coliform	200 counts/100 mL
Chloride	250 mg/L
Dissolved oxygen	At least 5.0 mg/L (24-h average) At least 4.0 mg/L at all times
Floating solids, petroleum hydrocarbons, oils and grease	None noticeable
Acidity	6.5-8.5 pH units
Total phosphorous	0.05 mg/L in lakes, 0.1 mg/L in streams
Radioactivity	Prevailing regulations[b]
Suspended solids	40.0 mg/L
Sulfate	250 mg/L
Organoleptic substances	None offensive to humans
Temperature	<2.8°C change from ambient in streams, <1.7°C change from ambient in lakes
Toxic substances (general)	Concentrations below levels that affect humans or are detrimental to aquatic life
Nonpersistent toxic substances	Concentrations no greater than 0.05 of acute definitive LC_{50} or EC_{50} values (EC_{50} is the concentration having a specified adverse effect on 50% of a test population; see page 3-18 for definition of LC_{50})
Persistent toxic substances	Concentrations no greater than 0.01 of acute definitive LC_{50} or EC_{50} values
Specific toxic substances (μg/L)	
Aldrin/Dieldrin	0.0019
Ammonia (un-ionized)	50 (24-h average)
Total arsenic	50
Total barium	1,000
Benzidine	0.1
Total cadmium	10
Chlordane	0.0043
Chlorine, total residual	3.0
Total chromium	50
DDT and metabolites	0.0010
Endosulfan	0.056
Endrin	0.023
Heptachlor	0.038
Total lead	50

TABLE 3.4 (Cont'd)

Parameter	Criteria
Specific toxic substances (µg/L) (Cont'd)	
Lindane	0.080
Total mercury	2
PCBs	0.014
Total selenium	10
Total silver	50
Toxaphene	0.013
Turbidity (NTU units)	15 NTU (30-d average) 50 NTU maximum at any time

[a]See footnote in Sec. 3.2.2.2 for definition of FW2 waters.

[b]Refers to prevailing regulations adopted by the EPA pursuant to Secs. 1412, 1445, and 1450 or the Public Health Services Act as amended by the SDWA (PL 93-123).

Source: NJAC 7:9-4.14(c).

3.3 HAZARDOUS WASTE

3.3.1 Federal

Solid wastes are divided into two types: hazardous and nonhazardous. According to the EPA (40 CFR 261), for regulatory purposes solid wastes are hazardous if they are listed as hazardous, have at least one of four characteristics of hazardous waste, or contain sufficiently high concentrations of one or more of a long list of hazardous constituents. Some of the hazardous wastes listed are produced by the manufacture of explosives. These consist of the wastes K044 (wastewater-treatment sludges from the manufacturing and processing of explosives); K045 (spent carbon from the treatment of wastewater containing explosives); K046 (wastewater-treatment sludges from the manufacture, formulation, and loading of lead-based initiating compounds); and K047 (pink-red water from TNT operations). Another type of hazardous waste consists of residues and contaminated soil resulting from the cleanup of spills of hazardous or toxic chemicals; such chemicals appear in two long federal lists. Sulfuric acid (including oleum) and nitric acid are not included on the lists (40 CFR 261, Subpart D).

Wastes that are not specifically listed, such as contaminated soils, are hazardous if they are ignitable, corrosive, reactive, or toxic. The reactivity characteristic includes explosivity. In particular, a solid waste is reactive if it is capable of (1) detonation or explosive reaction when subjected to a strong initiating source or heated under confinement or (2) detonation or explosive decomposition at standard temperature and pressure. Also, materials classified as forbidden, Class A explosives, or Class B explosives by the U.S. Department of Transportation are reactive (49 CFR 173.51,

TABLE 3.5 Groundwater Quality Criteria for GW2 and GW3 Waters[a]

Parameter	Criteria
Primary Standards	
Aldrin/Dieldrin	0.003 µg/L
Arsenic and compounds	0.05 mg/L
Barium	1.0 mg/L
Benzidine	0.0001 mg/L
Cadmium and compounds	0.01 mg/L
Chromium (+6) and compounds	0.05 mg/L
Cyanide	0.02 mg/L
DDT and metabolites	0.001 µg/L
Endrin	0.004 µg/L
Lead and compounds	0.05 mg/L
Mercury and compounds	0.002 mg/L
Nitrate (as N)	10 mg/L
Phenol	3.5 mg/L
PCBs	0.001 µg/L
Radionuclides	Prevailing EPA regulations
Selenium and compounds	0.01 mg/L
Silver and compounds	0.05 mg/L
Toxaphene	0.005 µg/L
Secondary Standards	
Ammonia	0.5 mg/L
Chloride	250 mg/L[b]
Coliform bacteria	See NJAC 7:9-6.6
Color	None Noticeable
Copper	1.0 mg/L
Fluoride	2.0 mg/L
Foaming agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor and taste	None noticeable
Oil, grease, and petroleum hydrocarbons	None noticeable
pH	5-9 (standard units)
Phenol	0.3 mg/L
Sodium	50 mg/L[b]
Sulfate	250 mg/L[b]
TDS	500 mg/L[b]
Zinc and compounds	5 mg/L

[a]See footnote in Sec. 3.2.2.3 for definitions of GW2 and GW3 groundwater.

[b]For GW3 groundwaters, these are replaced by natural background concentrations.

Source: NJAC 7:9-6.6.

173.53, 173.88). Forbidden explosives include compounds or mixtures that ignite spontaneously or decompose when heated to 75°C (167°F) for 48 consecutive hours, new explosive compounds, explosive mixtures or devices containing chlorate and either an ammonium salt or an acidic metal salt, liquid explosives such as nitroglycerin, and others. Class A explosives are detonating explosives, and Class B explosives are rapidly burning explosives such as propellants. Class A explosives include initiators and priming explosives, such as lead azide and mercury fulminate, and high explosives, such as TNT, dynamite (with or without a liquid explosive), tetryl, and black powder.

The characteristic of toxicity for a solid waste is determined by use of the toxicity characteristic leaching procedure (TCLP). The TCLP consists of tests performed on solid waste to determine the leachability of 40 chemical parameters that are toxic constituents of concern. The new rule, which replaces the old EP toxicity tests and parameter lists with those for the TCLP, was promulgated in March 1990 (Fed. Reg. 55(61):11,798-11,877, Thursday March 29), and became effective on September 25, 1990. The new TCLP contaminants and corresponding regulatory levels are listed in Table 3.6.

The determination of whether a material such as contaminated soil or waste is hazardous is the responsibility of the generator. If the solid waste is not specifically excluded from regulation, then the listings of Subpart D in 40 CFR 261 are checked to see if the wastes are specifically listed. If the waste is not listed and not ignitable, reactive, corrosive, or toxic (these characteristics apply to the contaminated material and not to the pure contaminant) (40 CFR 261, Subpart C), it can still be hazardous. In particular, a solid waste is hazardous if it contains at least one of a long list of toxic constituents listed in App. VIII of 40 CFR 261.11, unless the waste "is not capable of posing a substantial presence or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed." This determination is based on consideration of several factors, including the nature, concentration, and degradation rate and products of the constituent -- and the potential for the constituent or its degradation products to migrate into the environment under different but plausible types of improper management (40 CFR 261.11).

3.3.2 State of New Jersey

New Jersey definitions of hazardous waste are similar to those of the federal government. A solid waste is hazardous if it is not one of the wastes specifically excluded in NJAC 7:26-8.2 and if it meets any one of the following criteria (NJAC 7:26-8.1(a), 8.7, and 8.8):

- It is a listed hazardous waste.

- It contains a hazardous waste constituent listed in NJAC 7:26-8.16 and, after consideration of several factors, the NJDEP concludes that the waste is capable of posing a substantial threat or potential hazard to public health or the environment when improperly stored, treated, disposed of, or otherwise managed. These hazardous wastes are designated as toxic wastes.

TABLE 3.6 Toxicity-Characteristic Contaminants and Regulatory Levels

Contaminant	EPA Hazardous Waste Number	Chemical Abstracts Service Number	Regulatory Level (mg/L)
Arsenic	D004	7440-38-2	5.0
Barium	D005	7440-39-3	100.0
Benzene	D018	71-43-2	0.5
Cadmium	D006	7440-43-9	1.0
Carbon tetrachloride	D019	56-23-5	0.5
Chlordane	D020	57-74-9	0.03
Chlorobenzene	D021	108-90-7	100.0
Chloroform	D022	67-66-3	6.0
Chromium	D007	7440-47-3	5.0
o-Cresol[a]	D023	95-48-7	200.0
m-Cresol[a]	D024	108-39-4	200.0
p-Cresol[a]	D025	106-44-5	200.0
2,4-D	D016	94-75-7	10.0
1,4-Dichlorobenzene	D027	106-46-7	7.5
1,2-Dichloroethane	D028	107-06-2	0.5
1,1-Dichloroethylene	D029	75-35-4	0.7
2,4-Dinitrotoluene[b]	D030	121-14-2	0.13
Endrin	D012	72-20-8	0.02
Heptachlor (and its hydroxide)	D031	76-44-8	0.008
Hexachlorobenzene[b]	D032	118-74-1	0.13
Hexachlorobutadiene	D033	87-68-3	0.5
Hexachloroethane	D034	67-72-1	3.0
Lead	D008	7439-92-1	5.0
Lindane	D013	58-89-9	0.4
Mercury	D009	7439-97-6	0.2
Methoxychlor	D014	72-43-5	10.0
Methyl ethyl ketone	D035	78-93-3	200.0
Nitrobenzene	D036	98-95-3	2.0
Pentachlorophenol	D037	87-86-5	100.0
Pyridine[b]	D038	110-86-1	5.0
Selenium	D010	7782-49-2	1.0
Silver	D011	7440-22-4	5.0
Tetrachloroethylene	D039	127-18-4	0.7
Toxaphene	D015	8001-35-2	0.5
Trichloroethylene	D040	79-01-6	0.5
2,4,5-Trichlorophenol	D041	95-95-4	400.0
2,4,6-Trichlorophenol	D042	88-06-2	2.0
2,4,5-TP (Silvex)	D017	93-72-1	1.0
Vinyl chloride	D043	75-01-4	0.2

[a]If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration and corresponding regulatory level of 200 mg/L are used.

[b]Regulatory value is also equal to the quantitation limit.

Source: Federal Register, Vol. 55, pp. 11798-11877, March 29, 1990.

- It is a mixture of a solid waste and a listed hazardous waste (some exclusions apply).

- It is corrosive, reactive, ignitable, or extraction procedure (EP) toxic.

- It is listed in 40 CFR 261 Subpart D (including all future additions or supplements).

A solid waste that is not excluded from regulation under NJAC 7:26-8.2 becomes hazardous [NJAC7:26-8.1(b)]:

- When the solid waste first becomes a listed hazardous waste.

- If a hazardous waste is mixed with the solid waste.

- When the solid waste becomes reactive, ignitable, corrosive, or EP toxic.

- If the waste is unlisted and is not reactive, ignitable, corrosive, or EP toxic, when the NJDEP makes a final determination that the waste is hazardous.

- If the waste is listed in 40 CFR 261 Subpart D, when the waste first meets the listing description.

- When a hazardous waste is recycled and the recycled material has been stored, buried, land-disposed, or processed before becoming a commonly traded commercial product.

A solid waste generated from the treatment, storage, or disposal of a hazardous waste -- including sludge, spill residue, ash, emission control dust, or leachate (but excluding precipitation runoff) -- is a hazardous waste unless it is shown not to be hazardous according to several criteria in NJAC 7:26-8.6(d).

There are 21 specific wastes excluded from regulation as hazardous wastes. The specifically excluded wastes that may be relevant to PTA include (NJAC 7:26-8.2):

- Domestic sewage.

- Any mixture of domestic sewage and other wastes passing through a sewer system to a publicly owned treatment works for treatment.

- Industrial wastewater discharges that are point-source discharges subject to regulation under Section 402 of the Clean Water Act as amended (33 USC 125 et seq.).

- Source, special nuclear, or by-product materials as defined in the 1954 Atomic Energy Act as amended (42 USC 2011 et seq.).
- Household waste.
- Samples of solid waste or air, water, or soil collected for testing (this exemption applies only when the samples are being shipped or stored temporarily before or after testing).
- Used batteries awaiting reclamation, provided that the batteries are not stored for more than 90 days.
- Materials recycled on-site to the original production process that generated them (provided that certain requirements are met).

Listed hazardous wastes are any wastes listed in NJAC 7:26-8.13 (hazardous wastes from nonspecific sources); NJAC 7:28-8.14 (hazardous wastes from specific sources); and NJAC 7:26-8.15 (discarded commercial chemical products, off-specification species, containers, and spill residues thereof). Each of these lists appears to be quite similar to the federal lists in 40 CFR 261.31, 261.32, and 261.33. Also, the state uses the EPA hazardous waste numbers for the listed wastes. However, the state list of wastes from nonspecific sources has several wastes not on the federal list (Table 3.7).

Listed hazardous wastes from specific sources that are of special relevance to PTA are the explosive wastes. These wastes have the same definitions and classifications as those given by the EPA (Sec. 3.3.1 and NJAC 7:26-8.14).

New Jersey classifies hazardous wastes according to whether they have the characteristics of ignitability, corrosivity, reactivity, EP toxicity, and toxicity or whether they are acutely hazardous. A waste is acutely hazardous if (1) it is fatal to humans in low doses; (2) in the absence of data for humans, it has been shown to produce an oral LD_{50}* toxicity in rats at doses of <50 mg/kg, an inhalation LC_{50}* toxicity in rats at concentrations of <2 mg/L, or a dermal LD_{50} toxicity in rabbits at doses of <200 mg/kg; or (3) it is otherwise capable of causing or significantly contributing to an increase in serious irreversible or incapacitating reversible illness (NJAC 7:26-8.8). The definitions of these characteristics of hazardous wastes are essentially the same as those given in the federal regulations in 40 CFR 261.

3.4 THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

The HSWA of 1984, which amended RCRA, contain prohibitions on land disposal of certain hazardous wastes. In particular, land disposal (except deep-well injection) of hazardous solvent wastes (EPA numbers F001-F005) is banned as of November 8, 1986.

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*LD_{50} is the dose of a substance that is lethal to 50% of a test population, and LC_{50} is the concentration that is lethal to 50% of a test population.

TABLE 3.7 Hazardous Wastes from Nonspecific Sources Listed in NJAC 7:26-8.13, but not Listed in 40 CFR 261.31

Waste Number	Waste Description
X721	Waste automotive crankcase and lubrications oils from automotive service and gasoline stations, truck terminals, and garages
X722	Waste oil and bottom sludge generated from tank cleanouts from residential/commercial fuel oil tanks
X723	Waste oil and bottom sludge generated by gasoline stations when gasoline and oil tanks are tested, cleaned, or replaced
X724	Waste petroleum oil generated when tank trucks or other vehicles or mobile vessels are cleaned, including, but not limited to, oily ballast water from product transport units of boats, barges, ships, or other vessels
X725	Oil spill cleanup residue that is either contaminated beyond saturation or the generator fails to demonstrate that the spill material was not one of the listed hazardous waste oils
X726	The following used and unused waste oils: metal-working oils, turbine lubricating oils, diesel lubricating oils, and quenching oils
X727	Waste oil from the draining, cleaning, or disposal of electrical transformers
X728	Bottom sludge generated from the processing, blending, and treatment of waste oil in waste oil processing facilities

Source: NJAC 7:26-8.13.

Land disposal of wastes containing dioxins, chlorinated dibenzofurans, and some chlorinated phenols (EPA numbers F020-F023 and F026-F028) is banned as of November 8, 1988. However, solvent-contaminated soils (from non-CERCLA or RCRA corrective actions) containing less than 1% by weight total F001-F005 solvent constituents listed in Table 3.8, or soils or debris that are contaminated with any of the constituents listed in Table 3.8 and are generated in response actions taken under CERCLA or RCRA, are exempt from the ban until November 8, 1988. Until November 8, 1988, landfill disposal of the hazardous wastes is permitted only in a facility that is in compliance with the requirements specified in 40 CFR 268.5(h)(2). Extension of the November 8, 1988, deadline may be granted by the EPA on a case-by-case basis.

After November 8, 1988, wastes containing solvents or dioxins may be disposed of on land without treatment only if the waste or a liquid extract from the waste obtained by the TCLP satisfies the regulatory limits given in Tables 3.8 and 3.9. If the wastes do not meet the TCLP limits, they must be treated to meet the limits before they can satisfy the land-disposal standard. Although the choice of the method of treatment is up to the generator, dilution is not allowed. Between November 8, 1986, and

TABLE 3.8 Treatment Standards for Wastes Contaminated with F001-F005 Solvents (mg/L)

F001-F005 Solvent Constituents	Wastewaters Containing Spent Solvents	All Other Spent Solvent Wastes
Acetone	0.05	0.59
n-Butyl alcohol	5.0	5.0
Carbon disulfide	1.05	4.81
Carbon tetrachloride	0.05	0.96
Chlorobenzene	0.15	0.05
Cresols (and cresylic acid)	2.82	0.75
Cyclohexanone	0.125	0.75
1,2-Dichlorobenzene	0.65	0.125
Ethyl acetate	0.05	0.75
Ethyl benzene	0.05	0.053
Ethyl ether	0.05	0.75
Isobutanol	5.0	5.0
Methanol	0.25	0.75
Methylene chloride	0.20	0.96
Methylene chloride[a]	12.7	0.96
Methyl ethyl ketone	0.05	0.75
Methyl isobutyl ketone	0.05	0.33
Nitrobenzene	0.66	0.125
Pyridine	1.12	0.33
Tetrachloroethylene	0.079	0.05
Toluene	1.12	0.33
1,1,1-Trichloroethane	1.05	0.41
1,1,2-Trichloro-1,2,2-trifluoroethane	1.05	0.96
Trichloroethylene	0.062	0.091
Trichlorofluoromethane	0.05	0.96
Xylene	0.05	0.15

[a]From the pharmaceutical industry.

Source: EPA 1986c.

November 8, 1988, the TCLP limits apply only to solvent wastes not exempted from the 1986 ban.

The TCLP standards given in Table 3.8 do not apply to soils or debris contaminated with solvents because the limits are determined by applying the best demonstrated available technology (BDAT) to the wastes, which is incineration for nonaqueous wastes. The EPA has not yet determined a BDAT applicable to contaminated soils and debris.

According to the EPA (1986c), land disposal under the HSWA is defined to include placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or bed formation, underground mine or cave, or concrete vault or bunker. However, neither open burning nor detonation constitutes land disposal; thus,

they are not prohibited unless the residues resulting from the open detonation or burning of explosives are hazardous wastes.

The land-disposal restrictions are considered to be prospective; that is, they apply to wastes disposed of after the effective date of the prohibition. Wastes disposed of on land or placed in storage prior to the applicable effective date of prohibition do not have to be exhumed or removed for treatment. However, any hazardous wastes that are removed from a land-disposal or storage unit after the effective date of prohibition are subject to the disposal restrictions and treatment provisions (EPA 1986c; 40 CFR 268.2).

TABLE 3.9 Treatment Standards for Dioxin Wastes

Dioxin	Concentration
Hexachlorodibenzo-p-dioxins	<1 ppb
Hexachlorodibenzofurans	<1 ppb
Pentachlorodibenzo-p-dioxins	<1 ppb
Pentachlorodibenzofurans	<1 ppb
Tetrachlorodibenzo-p-dioxins	<1 ppb
Tetrachlorodibenzofurans	<1 ppb
2,4,5-Trichlorophenol	<0.05 ppm
2,4,6-Trichlorophenol	<0.05 ppm
2,3,4,6-Tetrachlorophenol	<0.10 ppm
Pentachlorophenol	<0.01 ppm

Source: EPA 1986c.

Additional hazardous wastes, e.g., those included in the "California list," are included among those the HSWA bans from the possibility of land disposal. A proposed rule bans these wastes from land disposal (except deep-well injection) as of July 8, 1987. Soil and debris that are contaminated with these wastes, and are generated as a result of response actions taken under CERCLA or RCRA authority, were exempt from the ban until November 8, 1988. Details on the proposed rule are given in the Federal Register (EPA 1987b).

3.5 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

SARA, enacted on January 21, 1986, includes provisions on federal facilities, cleanup standards, and an environmental restoration program to be carried out at U.S. Department of Defense (DOD) facilities. The federal facilities provisions (Sec. 120 of SARA) state that all federal facilities are subject to the same guidelines, rules, regulations, and criteria regarding hazardous substances that are applicable to any nonfederal facility. This applies in particular to preliminary assessments or remedial actions, evaluations under the National Contingency Plan, or inclusion in the National Priorities List (NPL). Also, as far as the NPL is concerned, a preliminary assessment of any federal facility must be started by July 21, 1987. A remedial investigation/ feasibility study (RI/FS) must be started within six months of listing on the NPL. If the facility was on the list on or before January 21, 1986, then an RI/FS must be started by January 21, 1987. Also, response actions at DOD or U.S. Department of Energy facilities may be modified as necessary to protect national security interests.

The SARA cleanup standards (Sec. 121) state that remedial actions in which the volume, mobility, or toxicity of hazardous substances or contaminants is permanently and significantly reduced by treatment are preferred to passive actions, such as land disposal

without treatment. Off-site transport and disposal without such treatment should be the least-preferred action if practicable treatment technologies are available. Any off-site transfer of hazardous substances must be to an approved facility. The unit receiving the hazardous substances must not be releasing any hazardous waste or constituent into the groundwater, surface water, or soil.

Remedial actions must be selected to attain a degree of cleanup that ensures protection of human health and the environment. Pollutants or hazardous substances remaining after completion of the remedial action are subject to all legally applicable or relevant and appropriate requirements. For a given site, these requirements are either "applicable," or they are "relevant and appropriate" -- but they are not both. Applicable requirements relate to cleanup or control standards or environmental limitations that specifically address a hazardous substance, remedial action, location, or circumstance at a CERCLA site. Relevant and appropriate requirements relate to cleanup or control standards or environmental limitations that address site situations sufficiently similar to those encountered at a CERCLA site so that the use of ARARs is well suited to the site under consideration. One type of ARAR consists of ambient or chemical-specific requirements, such as the MCLs (Table 3.1) or the National Ambient Air Quality Standards.

Section 121(d)(2) of CERCLA, as amended by SARA, states that remedial actions should satisfy ARARs under the SDWA, Clean Water Act, and RCRA. It also specifically requires that MCLGs and federal water-quality criteria (Table 3.1) should be satisfied where they are relevant and appropriate for the actual or potential release (EPA 1987c).

Section 211 of SARA describes an environmental restoration program for DOD facilities such as the PTA. The program is to be carried out in consultation with the EPA, and it is subject to the requirements given in Sec. 120 (federal facilities) of CERCLA. Goals of the program include the following:

1. Identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants.

2. Correction of other environmental damage (such as detection and disposal of unexploded ordnance) that creates an imminent and substantial threat to the public health or welfare or to the environment.

3. Demolition and removal of unsafe buildings and structures, including buildings and structures at sites formerly used by the DOD or under the jurisdiction of the Secretary of Defense.

3.6 SOIL ACTION LEVELS

Interim soil action levels (ISALs), as established by the state of New Jersey, have been in existence for several years. ISALs are soil concentrations of chemical parameters, which are used to determine the presence of contamination. If soil

concentrations exceed the ISALs then there is a need for soil sampling and other RI activity to determine the extent and level of contamination. ISALs are not cleanup objectives, although they may be so used. The numerical values of the ISALs are based on background concentrations for some chemical parameters and on health-based risk assessments for others. Table 3.10 lists the ISALs published by New Jersey (NJDEP 1990; Kurisko 1991).

At present the ISALs are to be used as guidance only as they have not yet been promulgated. However, a task force is working on developing rules and regulations that are expected to be out for public comment in the near future (Kurisko 1991).

TABLE 3.10 NJDEP Interim Soil Action Levels

Chemical Parameters	ISAL (ppm)
Inorganic	
Antimony	10
Arsenic	20
Barium	400
Beryllium	1
Cadmium	3
Chromium	100
Copper	170
Lead	250-1,000
Nickel	100
Mercury	1
Molybdenum	1
Selenium	4
Silver	5
Thallium	1
Vanadium	100
Zinc	350
Pesticides and PCBs	
DDT	1-10
Chlordane	1
PCBs	1-5
Other pesticides	Case-by-case
Surrogate Levels	
Total petroleum hydrocarbons	100[a]
Acid extractables	Case-by-case
Base neutral extractables	10[a]
Volatile organics	1[a]

[a]Values refer to total concentrations in each group and not concentrations of individual chemicals.

Source: Adapted from NJDEP 1990.

4 REMEDIAL INVESTIGATION SITES AND AREAS AT PICATINNY ARSENAL

Picatinny Arsenal is a large and complex installation that has been operating for more than 100 years. It would be expected to have many areas containing hazardous materials or disposed of hazardous waste. Some RI Sites were first identified in an installation report prepared in 1976 (USATHAMA 1976). In 1980, the list was expanded by EPA, which identified and evaluated 25 potentially hazardous Sites (Sites 1-25). Four additional Sites (Sites 26-29) were added during preparation of an application for a RCRA Part B permit to store and treat hazardous waste at PTA. Twenty-five additional Sites (Sites 30-54) were added as a result of an analysis of Sites in the RCRA facility assessment (Gaven 1986). PTA added Bldg. 255 to the list of Sites (as Site 55) in 1988.

In 1989, after ANL had begun to evaluate the original 55 Sites, USATHAMA and PTA decided to expand the scope of the investigation to include additional Sites. The expansion was based on the fact that many Sites exempted from the RCRA Part B permit application may have stored hazardous wastes in the past for more than 90 days or for unknown periods of time. Also, information provided by PTA employees raised the possibility that past practices may have led to contamination at several Sites.

To obtain information on past activities and possible contamination at PTA Sites, ANL staff interviewed former and current employees of the Arsenal during 1988 and 1989. All relevant information provided by the interviewees is included in this report and is explicitly noted as provided by interviews. To protect the individuals providing information and to encourage them to speak freely, the names of all interviewees are confidential.

Based on information obtained during the interviews and provided by PTA (which included lists of Sites generating and storing hazardous waste, the status of closure plans for various buildings, and similar materials), ANL staff prepared a master list of additional candidate Sites to be evaluated for their contamination potential. A building or area was included in the list if one or more employees reported that materials that are now considered hazardous were used or disposed of at the Site. The master list also included all information obtained during the interviews and provided by PTA.

ANL staff then evaluated the master list to create a shorter list of Sites having a potential for contamination due to activities at each Site. Selection criteria included reports of spills of hazardous material, reports of the handling of hazardous material in a manner that could contaminate the environment (e.g., burial of wastes or uncontrolled wastewater discharge), and storage of appreciable amounts of hazardous material. Some of the buildings and areas on the list were added to 11 of the original 55 Sites.

In July 1989, ANL sent the shorter list and supporting information to PTA and USATHAMA for review. PTA and USATHAMA approved the list with minor changes. In November 1989, PTA included four other Sites and finalized the list of 105 additional Sites. In May 1990, two Sites were deleted from the list. Three additional Sites were deleted in December 1990. Thus, this study evaluates a total of 156 Sites at PTA. A map of the Arsenal showing the locations of most of the Sites is provided in Plate 1.1

(USACE 1984a). (Sites 177 and 178, the sewer lines and buildings in the Toxic Energetics Cleanup Program [TECUP], respectively, were omitted from the map for clarity.)

To avoid confusion with earlier lists of Sites, there are gaps in the numbering sequence for some Sites. For example, an early list was prepared by PTA (known as "Major Riley's list"). Numbers assigned by Riley were used for those Sites on the Riley list selected for evaluation here. ANL staff did not reuse numbers assigned to Sites on the Riley list that were not selected for further evaluation (e.g., since Riley's Site 56 was not selected, the number 56 was not assigned to an RI Site).

An examination of the Sites shows that, based on the locations and type of activities at the Sites, they can be divided into several different groups or Areas. The Sites in each Area are all fairly close to one another and should have quite similar physical environmental characteristics. In general, the same type of activities were carried out at all the Sites in an Area. Consequently the potential environmental contaminants should be similar for all Sites in an Area. For the purposes of this RI Concept Plan, it is also easier to consider a smaller number of Areas of similar Sites than to consider each of the 156 Sites separately.

The specific grouping of the 156 Sites into 16 different Areas was chosen by USATHAMA and PTA and has been approved by the U.S. EPA Region II and the NJDEP. The grouping is shown in Table 4.1, which also gives a summary description of each of the 156 Sites at PTA. Within each Area the Sites are ordered according to increasing Site number. The Areas are shown on Plate 1.1 as solid lines enclosing the Sites within the Areas. The Area boundaries in Plate 1.1 are drawn to indicate which Sites are included in each of the Areas. They are not meant to assign an exact extent to the Areas.

In general, the Site names given are intended to briefly describe the environmentally significant activities at the Site. As shown in Table 4.1, 80 Sites are still in use and 73 are inactive; for three Sites (two lakes and a reservoir), such a description of status is inapplicable. The "comments" column describes the activities that provided the basis for considering each building or area as a Site. Activities referred to as "reported" generally were learned during interviews; other information was obtained during 1988 and 1989 visits to the Arsenal by ANL staff or was provided by PTA (e.g., lists of satellite, 90-day, interim, and special waste storage areas as well as other data). Each Site is characterized in greater detail in Volume 2 of this report.

Some of the Sites at PTA are currently managed under state or federal regulations. Hazardous waste storage or treatment activities at five Sites (Nos. 36, 38, 39, 42, and 43) are managed in accordance with RCRA requirements. Wastewater discharges at three Sites are included in an NJPDES permit (No. NJ0002500): Sites 37 and 40 discharge treated wastewater and Site 63 discharges noncontact cooling water and floor drain effluent. Activities at another Site (No. 34) are covered by a New Jersey open burning permit, which is renewed every six months. Also, for more than 52 Sites, part or all of each will be closed under RCRA; closure plans have been prepared for these Sites.

TABLE 4.1 Summary Descriptions of the 156 Remedial Investigation Sites at Picatinny Arsenal

Site Number	Site Location	Site Name	Current Status[a]	Comments
Area A: Burning Grounds				
34	Along S. Brook Road	Lower burning ground and open detonation area	Active	Open burning and detonation of explosive wastes, including lead azide; N.J. open burning permit renewed every 6 months
Area B: Southern Boundary, West of Green Pond Brook				
20	Within Site 24	Pyrotechnic testing range	Active	Developmental test firing of pyrotechnic munitions
24	Between S. Brook and Phipps Roads	Sanitary landfill	Inactive	Disposal until 1972 of sanitary waste and possibly fly ash, ordnance, industrial waste, and treatment plant sludge
Area C: Southern Boundary, East of Green Pond Brook				
19	Near S. Brook and Shinkle Roads	Pyrotechnic demonstration area	Inactive	Developmental test firing of pyrotechnic munitions
23	Near Bldg. 1150	Post farm landfill	Inactive	Disposal of industrial and municipal wastes and fly ash until 1979; drums disposed of near the Site
25	Along Spicer Avenue	Sanitary landfill	Inactive	Disposal of industrial waste and possibly treated sewage sludge and unexploded ordnance (UXO) until 1972
26	Within Site 25	Dredge disposal pile	Inactive	Pile of 12,000 yd^3 of sludge from Green Pond Brook; scheduled for sampling and closure
163	Near main entrance and Spicer Road	Baseball fields	Active	Reported to have been an open burning area and disposal area for material dredged from the brook
180	South of Site 19 and east of Site 34	Waste burial area	Inactive	Waste, such as railroad ties, railroad cars, telephone poles, and concrete, was reportedly dumped into wetlands
Area D: Central Manufacturing Valley				
21	Bldg. 24	Metal plating facility	Inactive	Plating operations produced hazardous components in wastewater. RCRA postclosure investigation based on documented groundwater contamination

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
37	Next to Bldg. 24	Surface impoundments for metal plating wastewater treatment	Inactive	Treats wastewater from metal plating activity; water and sludge disposed of off-post; facility and waste disposal regulated under RCRA
29	Bldg. 31 yard	Drum storage area	Inactive	Storage of waste oils in drums and 10,000-gal underground storage tank (UST); unauthorized dumping in 1984; documented soil contamination
39	Bldg. 31	Vehicle maintenance wastewater treatment facility	Active	Treats wastewater in oil/water separator; waste oil stored in 1,000-gal underground tank; facility regulated under RCRA
45	Bldg. 33	90-day waste accumulation area	Active	Less than 90-day storage of small amounts of waste oil from vehicle maintenance
49	Bldgs. 19 and 19A	90-day waste accumulation areas	Active	Less than 90-day storage of small amounts of soldering wastes from soldering facility
69	Bldg. 92	Surveillance laboratory	Active	Storage of waste oil generated from maintenance
86	Bldg. 12	Photoprocessing facility	Active	Storage of photographic waste
117	Bldg. 22	Precision machine shop	Inactive	Used in the 1960s to machine metals and DU; possible oil spills
118	Bldg. 41	Pesticide storage area and oil/water separator pond	Active	Storage of pestides; nearby pond was used as an oil/water separator
122	Bldg. 60	Satellite waste accumulation area	Active	Storage of oily rags and waste oil generated from hydraulic vibrator; storage of nuclear materials
123	Bldg. 64	Metal plating shop	Inactive	Assembly and disassembly area for objects containing Be and DU; Bear Swamp Brook was reportedly discolored by activities at the Site
182	Bldg. 5	Arsenal reproduction and training offices	Active	Building contains photoprocessing unit; waste from unit is stored in building
183	Bldg. 58	Graphic reproduction and training	Active	Photoprocessing operations; storage of waste from photoprocessing
Area E: Building 95 Area				
22	Near Bldg. 95	Waste impoundments for plating and etching facility	Inactive	Received wastewater from Bldg. 95 until 1981; RCRA postclosure investigation based on documented groundwater contamination
28	Bldg. 80	Sewage treatment plant sludge beds	Inactive	Received treated sewage sludge and wastewater before mid-1960s

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
38	Bldg. 95	Plating and etching wastewater treatment facility	Active	Treats wastewater from plating and etching activities; closure scheduled for three underground tanks; wastewater and sludge disposed of off-post; facility regulated under RCRA
44	Bldg. 39	Golf Course Maintenance Shop	Active	Less than 90-day storage of small amounts of oil and pesticide wastes
Area F: Propellant Area				
60	Bldg. 163	Photoprocessing laboratory	Active	Storage of waste generated from photographic development; UST scheduled for closure
61	Near Bldgs. 171 and 176	Waste dumps	Inactive	Possible disposal of propellants behind Bldg. 171; swamp area near Bldg. 176 may contain trash and other waste material
104	Bldgs. 161 and 162	Chemical laboratories	Active	Reports of chemicals dumped into sinks and propellants dumped behind Bldg. 162; possible mercury contamination
106	Bldg. 1010	Propellant plant	Inactive	Acid recovery area; leakage of storage tanks and transformers; building burned down in TECUP
111	Bldgs. 454 and 455	Propellant bag filling area	Active	Spills of propellant dust and grains on floor
124	Bldg. 166	Propellant testing building	Active	Used for propellant surveillance tests and propellant storage
125	Bldgs. 172 and 183	Office building and lubricant testing area	Active	Storage in Bldg. 183 of lubricant waste, adhesive, solvent, and acid from lubricant testing; Bldg. 172 has been used as an office building
126	Bldg. 197	Propellant testing building	Active	Storage of waste propellant generated from propellant testing
138	Bldgs. 404, 407, and 408	Chemical laboratory and propellant processing plants	Active	Bldgs. 404 and 407 were chemical laboratories used to research laboratory manufacture and burn propellants; Bldg. 408 used for chemical synthesis and melt casting of explosives; wastewater may be discharged to a nearby swamp; presently used for the storage of chemicals used in past operations
139	Bldg. 424	Propellant processing plant	Inactive	Storage of wastewater in a large tank in 1960s; slurry pipeline and decontamination pits may still be present

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
140	Bldgs. 427 and 427B	Propellant processing areas	Active	Powder extrusion presses; mixing of nitrocellulose, nitroglycerin, and HMX; currently used for storage of rags, alcohol, acetone, ethyl acetate or ether, and scrap and excess propellant from propellant processing; pits and catch tank may still be present
141	Bldg. 429	Propellant crushing area	Inactive	Catch tank present
142	Bldg. 435	Propellant solvent mixing area	Active	Building houses four to six large solvent mixers; possible solvent spills
143	Bldg. 436	Propellant processing area	Active	Waste generated from propellant mixing included 25 lb/yr contaminated rags and 25 gal/yr contaminated solvents
144	Bldg. 462	Propellant finishing plant	Inactive	R&D for energetics generated contaminated paper towels, rubber gloves, and plastic hardware; scrap propellant; explosives; and solvents
145	Bldg. 477	Explosive and propellant mixing area	Active	Mixing and drying of explosives and propellants and mixing of pyrotechnics
146	Bldg. 497	Powder pressing	Active	Reported powder pressing operations
Area G: DRMO Yard and Surrour 'ngs				
31	Bldgs. 314 and 314B-314E	Defense Reutilization and Marketing Office	Active	Storage of used lead-acid batteries
52	Bldgs. 305 and 336	Petroleum leak area and Bldg. 336	Inactive	Estimated 400-gal leak of petroleum products; three diesel fuel tanks are in the area
95	Bldg. 336	Former laundry facility	Inactive	Wastewater from laundry contained explosives, fire retardants, and detergent and was discharged to swamp; operations closed in the late 1970s or early 1980s; building was demolished
96	Bldgs. 301 and 301A	Waste oil storage area	Inactive	Storage of oil and paint stripper; apparent leakage
101	Bldgs. 311 and 319	Gasoline station and storage area	Active	Bldg. 311 was a gas station; 10,000-gal underground tank may have leaked since it was designed for aboveground installation
134	Bldg. 302	Service shops	Inactive	Former laundry that reportedly discharged wastewater containing explosives, fire retardants, and detergent into a swamp; reported disposal pit is now now paved over

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
135	Bldg. 315	Metallurgy laboratory	Active	Storage of oily rags and metal cuttings
136	Bldg. 355	Metallurgy laboratory	Active	Storage of waste from metallographic etching
Area H: Munitions Assembly				
55	Bldgs. 221, 223, and 225	Explosives machining facility	Active	Treats wastewater from melt loading of projectiles
62	Bldg. 210	Satellite waste accumulation area	Inactive	Temporary storage of hazardous chemicals, black powder, and hydraulic oil in 1960s; area was previously used as an explosives manufacturing area
64	Bldg. 241	Press loading and disassembly plant	Active	Initially built as an explosive D loading plant, then used for demilling and disassembly; used as electrical equipment storehouse since 1981
98	Bldg. 268	Mine assembly facility	Inactive	Manufactured antipersonnel mines
100	Bldg. 276	Explosives loading facility	Inactive	Used for loading explosives; possible soil contamination with explosives and waste oil; possible disposal into Bear Swamp; building burned down in TECUP
127	Bldg. 230	Explosives melt-casting and machining	Active	Storage of composition B and octol from melt casting operations
128	Bldgs. 235 and 236	Explosives pressing plants	Inactive	Bldg. 236 is active; scrap explosive generated
129	Bldg. 240	Changing house and dispatch center	Active	Reportedly, dioxin was stored in building about 25 years ago
130	Bldg. 252	Powder pressing and pelleting facility	Inactive	Wash water probably was discharged into swamp
131	Bldg. 266	Ordnance manufacturing facility	Inactive	Storage of waste oil and solvents
132	Bldgs. 271 and 2711-271N	Loading facility for detonators and initiators	Inactive	Used for producing detonators and initiators containing lead azide and tetryl; wash water containing explosives reportedly discharged onto ground
151	Bldg. 600	Change house	Inactive	Reported testing of hand grenades, rockets, and mines until about 1978
Area I: Around Picatinny Lake				
16		Guncotton line	Inactive	Abandoned pipeline that may contain dried nitrocellulose (guncotton)

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
30	Bldg. 3045	Fluorochemicals storage	Inactive	Storage of cylinders of fluorochemicals; Site was closed in 1982 without submission of closure plans or NJDEP approval
32	Bldg. 553	Storage tanks	Inactive	Storage of alcohol, spent alcohol, ether, diesel fuel, etc., in 11 aboveground tanks
33	Bldg. 527A	Storage tanks	Inactive	Storage of spent alcohol in two tanks (5,200 and 1,075 gal); scheduled for decontamination and closure
40	Bldgs. 809 and 810	Explosives manufacturing wastewater treatment facility	Active	Treats wastewater from explosives processing
46	Bldg. 507	90-day waste accumulation area	Active	Less than 90-day storage of small amounts of waste oil from train engine maintenance
47	Bldgs. 3005 and 3006	90-day waste accumulation areas	Active	Less than 90-day storage of small amounts of waste oil from equipment maintenance
50	Bldgs. 519 and 519A	Hazardous waste tank storage areas	Inactive	Storage of spent alcohol in one 3,800-gal tank; scheduled for decontamination and closure
53	Approximate center of PTA	Picatinny Lake	-	Probably contains defective ordnance, containers of explosives, and UXO from 1926 explosion
63/65	Bldg. 506	Steam and power plant	Active	Coal pile runoff entered nearby Picatinny Lake; storage of waste oil and material strained from waste oil; waste storage area and waste burning system scheduled for decontamination and closure
70	Bldgs. 3028 and 3029	R&D laboratory and general purpose warehouse	Active	Storage of waste explosives and contaminated solvents from R&D of propellants and explosives
71	Bldg. 910	General purpose laboratory	Inactive	Storage of propellants; ammunition testing lab scheduled for closure
79	Bldg. 3013	High-pressure boiler	Active	Waste oil storage area scheduled for closure; facility is used infrequently
82	Bldg. 908	X-ray photoprocessing laboratory	Active	Storage of waste oil and fixer solution generated from operation and maintenance of X-ray machine
83	Bldg. 3022	Physical analysis laboratory for energetics	Active	Storage of energetic material samples, and spent solvents generated from lab and R&D experiments
90	Bldg. 329	Electromagnetic gun test shed	Active	Storage of waste motor oil, acetone, ethyl alcohol, and oil rags generated from R&D of EM gun
93	Bldgs. 800 and 807	Ammunition demolition facility and ordnance facility	Inactive	Assembly, loading, and packing of aerial grenades
97	Bldg. 501	Post Engineer maintenance shop	Inactive	Pump repair shop; suspected mercury contamination

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
102	Bldg. 3050	Enlisted mens' barracks	Active	Car rack behind building used for vehicle maintenance; waste oil reportedly dumped onto the ground
105	Bldg. 511	Propellant plant	Inactive	PCB leakage from transformers; transformers removed about two years ago; building burned down in TECUP
108	Bldgs. 717, 722, and 732	Ordnance facilities	Inactive	Used to burn flares; pyrotechnics manufacturing; a flare fire reportedly occurred behind Bldg. 717; possible heavy metal contamination of soil
109	Bldg. 445	Pyrotechnic plant	Inactive	Manufactured flares; flare ingredients reportedly were washed into soils; nitro compounds in sump near building
110	Southeast of Picatinny Lake	500 area	Active	Explosives reportedly fell off of a train along the narrow-gauge railroad track
113	Bldg. 561	Propellant plant	Inactive	Possible soil contamination; building burned down in TECUP
137	Bldg. 382	Administrative building	Active	Reportedly, disposal pits near the building were used during the early 1940s-1950s; waste included paper products, ammo. boxes, tubes, and material dredged from Picatinny Lake
147	Bldg. 520	Poaching house	Inactive	Storage of nitrocellulose-water slurry mix in vats; waste disposed of in pits in basement; building burned down in TECUP
148	Bldg. 527	Change house	Inactive	Nitrocellulose processing; smokeless powder factory scheduled for closure
149	Bldg. 541	Propellant plant	Inactive	Storage of single-base powder grains in solvents; reported vat leak; building burned down in TECUP
150	Bldg. 555	Propellant plant	Inactive	Nitrocellulose chunks and water from powder operations were reportedly found in drainpipe;
156	Bldgs. 813, 816, and 816B	Ordnance facilities	Inactive	Reported assembly area where explosives were loaded and packed; high production before 1957; Picatinny Lake reportedly received discarded objects and discharged wash water
157	Bldgs. 820 and 823	Ordnance facilities	Inactive	Reportedly, shells were packed and sealed for shipping; shells steamed and washed out in buildings; washout water discharged into Picatinny Lake
158	Bldg. 926	High-explosives magazine	Inactive	Reported storage of lead azide and styphnates; they were removed in 1985

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
159	Bldg. 975	Samples and services administration building	Inactive	Reported storage of packed shells and other explosives prior to shipping; lead azide may have been buried behind building in 1983
178		TECUP buildings	Inactive	Buildings in program were destroyed by spraying them with diesel fuel and igniting it; drain lines possibly containing explosives were not removed; some buildings were washed
184	Bldg. 523	Refrigeration and inert gas plant	Inactive	Used for manufacturing refrigeration and inert gases; three underground tanks containing gasoline are located just outside the southeast wall of the building, which has been inactive since 1976
Area J: Around Snakehill Road				
1	G-2 Road	Reaction Motors/rocket fuel test area (G-2 area)	Inactive	Testing of rocket fuel and explosives containers; possible dump on east or southeast side of Site
2	3500 series bldgs.	Reaction Motors/rocket fuel test area (G-1 area)	Inactive	Testing of rocket motors; storage of liquid fuels
4	3600 series bldgs.	Reaction Motors/rocket fuel test area	Inactive	Testing of rocket motors
175	Bldg. 380	Helicopter building	Active	Floor drains in shop area reportedly drain to swamp
Area K: Navy Hill				
3	1500 series bldgs.	Reaction Motors/rocket fuel test area	Active	Testing of rocket motors and munitions; documented beryllium contamination in soil
48	Bldgs. 3314 and 3315	90-day waste accumulation areas	Active	Less than 90-day storage of small amounts of waste oil from equipment maintenance
172	Bldg. 3328	Parking lot near calibration facility	Active	Reportedly, oil, possibly containing PCBs, was spilled onto the paved parking lot
173	Bldg. 3404	Administration and supplies building	Active	Previously used as a solid propellants chemical laboratory; storage of chemical waste
174	Bldg. 3420	Old sewage plant	Inactive	Former holding ponds and beds for sewage sludge
Area L: Explosives Manufacturing				
5	Near Bldg. 3150	Shell burial area	Inactive	Burial of explosive devices during 1926-1945
6	Near Bldg. 3100	Shell burial area	Inactive	Burial of explosive devices during 1926-1945

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
17	Near Bldg. 1095	Northern tetryl pit	Inactive	Disposal of waste from tetryl manufacture until 1945
18	Near Bldg. 1031	Southern tetryl pit	Inactive	Disposal of waste from tetryl manufacture until 1945
35	Near Bldgs. 1361A, 1363A, 1364, and 1365	Nytroglycerin processing area	Inactive	Storage of spent nitric and sulfuric acids in tanks; tanks scheduled for decontamination and closure; Site also includes catch basin and stagnant water near buildings
36	Bldg. 3100	Hazardous and nonhazardous waste storage area	Active	Storage of waste oil; storage capacity is 772 drums; Site is being renovated and is RCRA regulated
41	Bldg. 1094	Lab-pack repacking and storage facility	Acrive	Storage of toxic chemical wastes and spent reagents; facility regulated under RCRA
42	Bldg. 3114	PCB storage area	Active	Storage of PCB-contaminated waste oil, capacitors, and leaky transformers; RCRA-regulated facility
43	Bldg. 3157	Pesticides storage area	Active	Storage and mixing of pesticides; cleaning of contaminated application equipment; facility regulated under RCRA
51	Bldg. 1380	Hazardous waste tank storage area	Inactive	Storage of spent nitric and sulfuric acids in two 3,000-gal tanks; scheduled for decontamination and closure
77	Bldg. 3150	Machine shop and waste storage area	Active	Building houses gym and machine shop for metal and plastic; basement storage area and underground tanks scheduled for closure
91	Bldg. 1301	Rocket motor assembly	Active	Storage of small amounts of waste solvents and energetic wastes
103	Near Bldg. 3159	Reservoir	-	May contain UXO
114	Bldg. 1033	Filling plant for cast high explosives	Inactive	Used for loading explosives; filtered pink/red water reportedly was discharged into stream
160	Bldg. 1029	Ordnanace facility	Active	Analysis activities generate waste propellant, nitrocellulose, and tetrahydrofuran; satellite accumulation of wastes on concrete floor
161	Bldg. 1031	Nitration building	Active	TNT, HMX, and RDX plant; building scheduled for decontamination and closure
162	Bldgs. 1070, 1071, and 1071C	Explosives manufacturing and storage facilities	Active	Used for chemical storage prior to 1986; flammable materials currently stored in Bldg. 1071C; explosives wastewater leaching field may be present
166	Bldgs. 1354, 1357, and 1359	Propellant buildings	Inactive	Reported spills of nitroglycerin inside buildings

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
167	Bldgs. 1373 and 1374	Ordnance facility and propellant plant	Inactive	Used to blend nitroglycerin/nitrocellulose slurries; contaminated sumps in Bldg. 1373
168	Bldgs. 1400, 1402, and 1403	Propellant plants and press house	Active	In Bldgs. 1400 and 1402, scrap propellant generated from sheet propellant production is stored on floor; Bldg. 1400 sump contains water but has not been used since 1981 In Bldg. 1403 (press house), scrap propellant and contaminated rags and solvents generated from mixing and propellant extrusion are stored on floor; possible spills; two sumps in use
169	Bldgs. 1408, 1408A-1408C, 1409, and 1411	Propellant plants	Inactive	Water containing HMX, RDX, TNT, and nitroglycerin discharged into swamp between Bldgs. 1408A and 1408B; waste solvents and rags from propellant mixing stored on floor in Bldgs. 1408 and 1408C; scrap energetic material stored on floor in Bldg. 1409; a catch basin at the Site is possibly contaminated
170	Bldgs. 1462, 1463, and 1464	Explosives plants	Inactive	Reportedly used for pilot plant R&D until 1980 or 1981; storage of potassium perchlorate and unknown chemicals; wastewater discharged outside; possible contamination includes TNT, comp. B, phosphate esters, and hydraulic fluid
171	Bldgs. 3106, 3109, and 3111	Ordnance facility	Active	Testing of munitions; machinery repairs and leaks generate waste oil, which is stored in the buildings on concrete floors
176	Near Walsh and Schrader Roads	Little League baseball field	Active	Reportedly used as a burning ground; possible contamination from dredge materials reportedly applied to field in 1983
177		Sanitary sewer lines breaks/leaks	Active	Possible leakage of clay sewer pipes; chemical labs, photo shops, and other operations reportedly dumped chemicals into sewers
Area M: 600 Buildings Area				
15	Bldgs. 616 and 654	Munitions test area	Active	Developmental testing of munitions
115	Bldg. 611	Ordnance facility	Active	Storage of aerosol cans; reported red seepage in soil from 528 area

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
152	Bldgs. 604 and 604C, tanks 604C-T1 and 604C-T2	Ordnance facility	Active	Explosives-contaminated water stored in underground storage tank; underground catch basin and tanks T1 and T2 are scheduled for closure
153	Bldg. 606	Ordnance facility	Active	Storage outside of building of X-ray fixer and developer waste generated from X-ray developing
154	Bldg. 617	Munitions and explosives testing	Inactive	Reported testing of munitions and explosives
	Bldg. 617G	Ordnance facility	Active	Storage of waste inside machine shop generated from fabricating test fixtures and modifying ammunition
155	Bldgs. 620 and 620B	Ordnance facilities	Active	Inside storage of waste from testing, including 111-trichoroethane, propellants, and explosives
Area N: Firing and Test Ranges				
7	Bldg. 1242	Munitions and propellants test area	Inactive	Developmental testing of munitions and propellants
8	Bldg. 1222	Munitions and propellants test area	Active	Developmental testing of munitions and propellants
9	Bldgs. 670, 673, and 674	Munitions and propellants test area	Active	Developmental testing of munitions and propellants
10	Along Berkshire Trail	Chemical burial pit	Inactive	Disposal of toxic chemical wastes, including cyanides and fluoroacetates
11	Bldgs. 647, 649, and 650	Munitions test range	Active	Developmental testing of munitions
12	Bldg. 656	Munitions waste pit	Active	Disposal of armament components
13	Bldg. 640	Munitions and pyrotechnics test area	Active	Developmental testing of munitions and pyrotechnics
14	Bldg. 636	Munitions test area	Active	Developmental testing of munitions
Area O: Lake Denmark				
54	Northeast end of PTA	Lake Denmark	-	Used as impact area for mortars and other munitions; probably contains UXO from 1926 explosion
164	Bldg. 1217	General purpose magazine	Active	Storage of propellant material; propellant materials reportedly opened outside
Area P: Miscellaneous Storage				
27	Near Shinkle and S. Brock Roads	Former salt storage area	Inactive	Storage of road salts in building; building will be removed
78	Bldg. 91	Optics prototype processing facility	Active	Storage of waste solvent, oil, and acid

TABLE 4.1 (Cont'd)

Site Number	Site Location	Site Name	Current Status[a]	Comments
94	Bldgs. 1600, 1601, 1604, 1609, and 1610	Ordnance facilities	Inactive	Test firing of pyrotechnics; nuclear materials and atomic cannon developed at Site; storage of waste generated from photographic development
119	Bldgs. 46-48	Propellant storage area	Active	Storage of propellant
120	Bldg. 50	Propellant storage area	Inactive	Storage of propellant; small quantities of material may have spilled onto ground
121	Bldg. 57	Chemical storage area	Active	Storage of chemicals, gas, nitrogen, and oxygen; possible leakage

[a]Current s,atus is as of May 1989. Active and inactive do not refer to the RCRA definition of these terms.

Each of the 16 Areas listed in Table 4.1 has been prioritized by USATHAMA and PTA with respect to the need for RI activity. The prioritization, which has been approved by the U.S. EPA and the NJDEP, is based on the potential for adverse effects on public health and the environment.

The results of the ranking are given in Table 4.1 in that the Areas are listed in the table in the order of their ranking; that is, Area A has the highest rank and is presented first in the table, Area B has the next highest rank and is presented next, and so on down to Area P, which has the lowest rank and is presented last in the table. The ordering of Areas and of Sites within each Area shown in Table 4.1 is preserved throughout this document. In particular, this is the case for Chapter 5 of Volume 1 and all of Volume 2.

The ranking shown in Table 4.1 is based on such factors as location with respect to water movement off PTA, the documented existence and extent of soil, surface water, or groundwater contamination, the status of required regulatory action on sites, etc. Area A, Burning Grounds, is assigned the highest ranking because a RCRA Subpart X permit application has already been filed for operating Site 34, the Burning Grounds. Since it is hoped to obtain the permit in 1992, it is important that the work needed to bring the Site into RCRA compliance be expedited and completed in time to obtain the permit.

Areas B and C, Southern Boundary, West and East of Green Pond Brook, respectively, are ranked next because of the potential for contamination to move off the southern boundary of the arsenal and affect the downgradient communities. The assignment of a higher rank to Area B than to Area C is arbitrary.

Area D, the Central Manufacturing Valley, is next in the ranking because Sites in the Area have the most extensive documented contamination in the Arsenal. Groundwater contamination originating from activities in Bldg. 24 is the main reason PTA was listed on the NPL. Interim remedial activities are also underway in the Area.

Area E, the Building 95 Area, is ranked next because of documented groundwater contamination and the contribution of Sites in the Area to the listing of PTA on the NPL. Area F, the Propellant Area, is next because it contains drinking water wells that are known to be contaminated.

Areas G and H, the respective Defense Reutilization and Marketing Office (DRMO) Yard and Munitions Assembly Areas, are next because of the potential to contaminate Green Pond Brook. Area G is known to be contaminated and is next to Green Pond Brook. Area H includes Bear Swamp Brook, which is a tributary to Green Pond Brook. Regulatory agencies are also interested in investigations of Bear Swamp Brook.

Area I, Around Picatinny Lake, is ranked next because the lake is an alternate water supply for the Arsenal. The next, Area J, Around Snakehill Road, includes the headwaters for Ames Creek, which flows off the Arsenal. This Area is ranked below those around Green Pond Brook because of the much lower potential for contamination of Ames Brook.

The ranking of the last six Areas is somewhat arbitrary. Area K, the Navy Hill Area, was the site of the 1926 explosion. There is a potential for explosives contamination of soil and water in Area L, the Explosives Manufacturing Area. Area M, the 600 Buildings Area, is part of the headwaters of Bear Swamp Brook, and Area N, Firing and Test Ranges, has some potential for generating contamination, some of which might ultimately end up in Picatinny Lake. Lake Denmark (in Area O), which should have less potential for contamination than Picatinny Lake, is used for recreation. Area P, Miscellaneous Storage, contains Sites that have been used for storage of wastes, chemicals, propellants, and road salt.

5 SUMMARY OF PROPOSED RI PLANS

5.1 INTRODUCTION

This section provides summaries of the proposed RI plans for each of the 156 Sites grouped into 16 Areas; Sec. 5.2 briefly describes the proposed activities for each Site, and Sec. 5.3 tabulates the sampling and survey activities. Details and other Site information are given in Volume 2. Types of activities proposed in the RI sampling plans include, but are not limited to, collecting surface soil samples and surface water samples; conducting soil gas and geophysical surveys; drilling soil borings to collect subsurface soil samples; and installing wells to monitor groundwater quality.

The proposed sampling plans for each Site are fairly detailed and compose, in essence, a summary work plan. Details, such as sampling depths and intervals, are given for many sampling activities. Unless explicitly stated otherwise, some procedures are the same for all Sites. All soil borings should be drilled to bedrock or the water table, whichever comes first. Water elevations should be measured in monitoring wells at the time samples are collected. Also, where a plan calls for the "disposal of" contaminated materials, such materials should be disposed of in an appropriate manner.

The sampling plan for each Site is divided into phases. Activities in Phase I should be carried out unconditionally and independently of any closure sampling, Phase II activities are contingent on the results of Phase I, and Phase III activities (if any) in turn are contingent on the results of Phase II. The only exception is for Phase I sampling activities that depend on the results of field inspections and surveys that are also included in Phase I.

Conditional activities (i.e., in Phase II or III) are often expressed in the proposed RI plans with terms such as "if significant contaminant concentrations are found, ..." or "if the Phase I samples are significantly contaminated, ..." The levels of "significant" contaminant concentrations, which will be different for different parameters, will be those selected as mutually agreeable to the U.S. Army, the EPA, and New Jersey.

Analytic parameters for the samples to be collected at each Site are often given as names of standardized lists or categories of parameters, including target compound list (TCL) metals, TCL volatiles, TCL semivolatiles, TCLP metals or TCLP leachabiality, explosives, propellants, herbicides, pesticides, macroparameters, and others. The specific chemical parameters in each of the categories used in this report are given in separate tables in App. C.

Analyses for pesticides or herbicides are recommended in the RI sampling plans for several Sites. This is done because pesticides and herbicides were used at the Arsenal to control pests and weeds at many locations including buildings housing explosive or propellant operations (Rigassio et al. 1975; USAEHA 1979a).

Consideration should be given to collecting background samples for each Area and analyzing the samples for metal and inorganic parameters. However, finding locations for sampling that are representative of true background conditions may be

difficult because Picatinny Arsenal has been active for such a long time, 100 years or more. The problem is that it is difficult to be sure that concentrations of metal or inorganic parameters measured at an assumed background location are naturally occurring, as they may represent contamination from undocumented activities that occurred in the past. Background concentrations of organic parameters of interest (App. C) should be essentially zero.

Soil borings and additional monitor wells are recommended at many Sites. Unless otherwise specified, soil borings should be drilled down to bedrock or the water table, whichever comes first. Three samples should be collected for analysis from each boring; one from the top, one from the middle, and one from the bottom. Each sample should be collected over a 0.6-m (2-ft) interval. Adequate safety precautions must be implemented during the drilling of soil borings, especially at Sites where borings are recommended at locations of geophysical survey anomalies.

Unless otherwise specified, the sampling protocol for both new and existing monitor wells should consist of collecting one sample for analysis from each recommended well on two successive quarters (a total of two samples per well). In general, monitoring should stop for each well for which the two samples show no significant contamination. However, quarterly monitoring should continue for any well for which the samples show significant contamination. Continued monitoring of wells that are close to and downgradient of any well showing significant contamination should also be considered.

For each Site, all activities described in the proposed RI plans are to be carried out using the quality assurance and quality control procedures given by USATHAMA (1987a, 1987b). These procedures are incorporated here by reference. Appropriate health and safety procedures must also be carried out during all proposed RI activities.

Brief summaries of RCRA closure plans are included in the sampling plan summaries for each Site for which closure plans will be implemented. For most of the Sites with closure plans, it cannot be documented that hazardous waste has not been stored in the past at the Site for more than 90 days; these Sites will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status. The closure plans and their revisions are described in Foster Wheeler (1988a, 1988b, 1988c, 1988d, 1988e, 1989), Solecki (1989a), and ARDEC (undated).

For each Site with a closure plan, the proposed phased sampling activities are designed to complement the closure plan and avoid duplication of sampling efforts. Proposed activities will be carried out independently of implementation of the closure plan. All the closures are scheduled to be clean closures, that is, decontamination to the extent that the regulatory agency (e.g., the NJDEP) certifies that no measures are needed to restrict the future use of or access to a Site. If, for any Site, clean closure is not possible, the proposed RI sampling plan may have to be modified.

5.2 SITE-SPECIFIC PLANS

This section summarizes the proposed RI sampling plans for the Site in each of the 16 Areas. The order of presentation of the Areas and of the Sites within each Area is

the same as that used in Table 4.1 and Volume 2. Additional discussion for each Site, as well as Site maps showing proposed sampling locations, can be found in Volume 2 of this report.

5.2.1 Area A: Burning Grounds

5.2.1.1 Site 34 — Lower Burning Ground

- Conduct a geophysical survey to locate any buried shells and areas of contamination. Conduct a ground-penetrating radar survey to investigate the subsurface geology.
- Collect continuous core samples to characterize the particle size distribution, porosity, and hydraulic conductivity of soils in the area.
- Conduct an RI/FS in accordance with Task Order Number 20, issued by USATHAMA in January 1990.

5.2.2 Area B: Southern Boundary, West of Green Pond Brook

5.2.2.1 Site 20 — Pyrotechnic Testing Range

- Collect four surface soil samples near the edges of the Site.
- Analyze the samples for TCLP leachability.
- See the recommendations for Site 24 for other activities for this area.

5.2.2.2 Site 24 — Sanitary Landfill

Phase I

- Install three monitoring wells west and southwest of the Site. Because of mounding and the shallow water table in this area, place the wells far enough away from the landfill so the well screens can straddle the water table. Distance depends on the depth to water and on best field judgment. Collect groundwater samples and measure water levels.

- Analyze samples for all TCL compounds, explosives, and uranium. After the initial sampling, sample the wells quarterly for significant contaminants.

- Collect two sediment and two surface water samples from the southern drainage ditch upgradient and outside of the boundary of the study area. Collect the same number of sediment and surface water samples from the northern drainage ditch between the pond and brook.

- Analyze the surface water and sediment samples for TCL parameters, explosives, TCLP leachability (sediment samples only), and uranium.

Phase II

Install additional monitoring wells and drill soil borings if warranted by the results of the Phase I sampling program.

5.2.3 Area C: Southern Boundary, East of Green Pond Brook

5.2.3.1 Site 19 — Pyrotechnic Demonstration Area

- Collect groundwater samples for two quarters from monitoring wells DM19-1, DM19-2, and DM19-3.

- Analyze the samples for volatile organics and metals.

5.2.3.2 Site 23 — Post Farm Landfill

Phase I

- Sample the contents of, and the soil near, each drum in the wooded area southwest of the landfill. Analyze the samples for TCL volatiles, TCL semivolatiles, TCL metals, PCBs, pesticides, explosives, and propellants.

- Excavate and properly dispose of these drums and contaminated soil if contamination is confirmed.

- Install two new water-table wells, one west and one south of the southern part of the landfill.

semivolatiles, explosives, propellants, pesticides, PCBs, TCL metals, nitrite, nitrates, ammonia, gross alpha, gross beta, and macroparameters.

- Conduct slug tests for the two new wells and wells DM23-1 and DM23-2; measure static water levels in all wells quarterly for one year; and assess the groundwater flow regime.

Phase II

- Continue the monitoring program if warranted by the new data on groundwater flow and quality.

- Determine the need for additional soil sampling and monitoring wells.

5.2.3.3 Site 25 — Landfill near South Boundary

Phase I

- Sample surface water and sediments quarterly for one year at locations SW25-1 and SW25-2 on Green Pond Brook. Analyze samples for all TCL parameters, explosives, gross alpha, gross beta, nitrite, nitrate, macroparameters, and TCLP leachability (sediment samples only).

- Install three new water-table monitoring wells in the area between the landfill and the Arsenal boundary and install two new water-table wells northeast of the landfill.

- Collect groundwater samples from all existing wells, including the ten wells on Site 25 (DM25-1 through -5; MW-16 and MW-17; and LF-1, LF-2, and LF-3) and the nine wells in the three well clusters (i.e., SB1, SB2, and SB3) recently established near the PTA southwest boundary, and the five proposed new wells (24 wells altogether). Sample the wells for two quarters.

- Analyze all water samples for all TCL parameters (except for PCBs and pesticides), explosives, nitrite, nitrate, gross alpha, gross beta, and macroparameters.

- Conduct aquifer slug tests for selected wells (suggested wells are DM25-3, DM25-5, and LF-1), measure static water levels in all wells quarterly for one year, and assess the groundwater flow regime in the area.

- Determine whether the glacial aquifers at PTA are hydraulically connected to the Quaternary aquifer in the Rockaway River Basin area.

Phase II

Review the surface water and groundwater sampling results after the respective Phase I sampling programs are completed.

5.2.3.4 Site 26 — Dredge Disposal Pile

Closure Plan

The revised RCRA closure plan for the dredge disposal pile includes the following:

- Random sampling methods will be used to collect 10 dredge samples composited from the pile surface to the interface between the pile and natural soil. Six samples will be analyzed for all EP toxicity parameters, reactivity (including reactive cyanide and sulfide), total petroleum hydrocarbons, and PCBs. Four samples will be retained as spare samples.

- Further sampling will be required only if the dredge pile is classified as hazardous waste by the NJDEP. Samples from 0 to 6 in. deep will be collected and analyzed for the same parameters listed above. The number of samples to be taken will be determined by NJDEP and ARDEC when the hazardous nature of the pile is determined.

Proposed RI Plan

Phase I

Monitor the groundwater with the existing well network in the area. Coordinate the monitoring for Site 26 with that for Site 25.

Phase II

If clean closure of the dredge pile is not possible, develop additional sampling.

5.2.3.5 Site 163 — Baseball Fields

Phase I

- Use groundwater data from Site 25 to determine the groundwater flow direction and quality.
- Conduct a geophysical survey on the Site to locate potential contamination areas and the reported disposal pits.
- Drill one soil boring in each area of a located geophysical anomaly, and collect soil samples from the top, depth of pit bottom or anomaly, and bottom of each boring.
- Analyze the soil samples for furans, dioxins, PCBs, cyanide, TCL volatiles, TCL semivolatiles, TCL metals, propellants, and explosives.

Phase II

Determine the need for additional monitoring wells and soil and groundwater samples based on the results of Phase I.

5.2.3.6 Site 180 — Waste Burial Area near Sites 19 and 34

Phase I

- Inspect all areas near the Site for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface water sample and one sediment sample from three locations in the swampy area. Determine locations by field inspection.
- If possible, conduct a geophysical survey to locate the disposal area.
- If the disposal area is found, a grid should be established and samples should be obtained from a depth of 0.6 m (2 ft) using a hand auger. If the disposal area cannot be found, collect 10 soil samples at random from a depth of 0.6 m across the Site area.
- Analyze all samples for all TCL parameters except dioxin.

Phase II

- Drill one soil boring in each area of significant soil contamination identified during Phase I. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the Phase I soil samples.

- Determine the need for monitoring wells based on the results of the soil boring analyses. Coordinate any well placement with the placement of new wells for Site 34 and the existing wells at Site 19.

- Analyze groundwater samples from any new wells for the parameters present at elevated concentrations in the soil boring samples.

5.2.4 Area D: Central Manufacturing Valley

5.2.4.1 Sites 21 and 37 — Building 24, Metal Plating Facility and Surface Impoundments

- Collect groundwater samples for two quarters from all 33 wells installed in this area in 1987 by the USGS.

- Analyze the groundwater samples for TCL volatiles, TCL metals, radon-220, and radon-222.

- Upon approval by the NJDEP, close the lagoons at Site 37 according to the closure plan developed in accordance with NJAC 7:26-10.6(h).

5.2.4.2 Site 29 — Building 31 Yard, Drum Storage Area

Closure Plan

Revised RCRA closure plans for the Bldg. 31 Yard, Drum Storage Area include the emptying and excavation of the 10,000-gal UST and piping from the storage area. Soil samples will be collected from three soil borings drilled in the area. Stained soil will be excavated and drummed. A composite soil sample will be collected of the drummed stained soil. All samples will be analyzed for priority pollutant metals, VOCs, PCBs, and if needed, EP toxicity (metals).

Proposed RI Plan

The proposed action for Site 29 is to complete the closure plan.

5.2.4.3 Site 39 — Building 31, Vehicle Maintenance Wastewater Treatment Facility

Upon approval of the closure plan by NJDEP, remove the 1,000-gal UST.

5.2.4.4 Site 45 — Building 33, 90-Day Waste Accumulation Area

Phase I

- Inspect the exterior of the building for visible contamination, spills, and leaks.
- Collect surface soil samples to a depth of 0.15 m (6 in.) outside the access doors and in any areas with visible contamination.
- Analyze the samples for TCL volatiles and TCL semivolatiles.

Phase II

If warranted by the results of the soil sampling, excavate and dispose of the contaminated soil and conduct confirmation sampling.

5.2.4.5 Site 49 — Buildings 19 and 19A, 90-Day Waste Accumulation Area

Closure Plan

The revised RCRA closure plan includes removing wastes; washing and rinsing both buildings; and collecting two wash water samples from each of the two buildings, four chip samples from Bldg. 19, and two chip samples from Bldg. 19A. The wash water and chip samples will be analyzed for priority pollutant metals. If the floor of Bldg. 19A is cracked, one soil sample will be collected through the crack and analyzed for VOCs, priority pollutant metals, and, if necessary, EP toxicity for metals.

If an area is found contaminated, additional surface and subsurface soil samples will be collected to delineate the extent of contamination.

Proposed RI Plan

No activities in addition to those in the closure plan are proposed unless the soils are contaminated, in which case surface water and groundwater should be sampled and monitored.

5.2.4.6 Site 69 — Building 92

Closure Plan

Revised RCRA closure plans include sampling and disposing of the containers of stored chemicals and high pressure water cleaning of the laboratory table tops in Room 18, a storage cabinet, and a paint locker storage bin. Two rinsate samples will be collected along with two chip samples from each cleaned area and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area. Collect one soil sample each to a depth of 0.6 m (2 ft) from three locations around the underground tank.

- Collect two surface water and sediment samples from the location of the former outfall at Bear Swamp Brook.

- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, sulfate, and cyanide.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination.

- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of soil boring analyses.

5.2.4.7 Site 86 — Building 12

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways. In the absence of visible contamination, no further action is required.

- Determine the need for additional sampling based on the field inspection.

5.2.4.8 Site 117 — Building 22

Phase I

- Inspect the Site and surrounding area for visible contamination.

- Collect one surface soil sample from each area of stained soil.

- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.

- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).

- Analyze all soil, surface water, and sediment samples for TCL volatiles, TCL semivolatiles, uranium, and TCL metals.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.4.9 Site 118 — Building 41 (Pesticide Storage) and Oil-Water Separator Pond

Phase I

- Collect one sediment sample from the brook at the outlet of the underground pipe and collect two sediment samples and two water samples from the oil-water separator pond.

- Analyze the sediment and water samples for TCL volatiles, TCL semivolatiles, TCL metals, cyanide, PCBs, pesticides, and herbicides.

Phase II

- If significant contamination is found in the Phase I samples in the pond, install at least one shallow well between the pond and the brook to monitor groundwater flow and quality.

- Analyze the groundwater samples for the chemicals found in Phase I analysis.

5.2.4.10 Site 122 — Building 60

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect one surface soil sample from thee locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.

- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).

- Analyze all samples for TCL volatiles, TCL semivolatiles, and explosives.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.4.11 Site 123 — Building 64

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).
- Analyze all soil, surface water, and sediment samples for TCL metals, uranium, nitrate, sulfate, and cyanide.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.4.12 Site 182 — Building 5

Closure Plan

Revised RCRA closure plans for Bldg. 5 include removing hazardous waste and any contaminated floor tiles and washing the building with detergent. Two wash water or rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area around Bldg. 5 for signs of contamination or staining. Do nothing further if the area appears to be clean.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of each visibly contaminated area.
- Analyze the samples for cyanide and TCL metals.

Phase II

- If the surface soil samples contain significant silver concentrations, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the samples for cyanide and TCL metals.

Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

5.2.4.13 Site 183 — Building 58

Closure Plan

The revised RCRA closure plan for Bldg. 58 includes decontaminating the photoprocessing facility. Two wash water or rinsate grab samples and two chips will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area outside the building.
- Analyze the soil samples for cyanide, and TCL metals.

Phase II

- Drill one soil boring in each area of significant soil contamination and collect samples from each boring.
- Analyze the samples for the contaminants found in the Phase I samples.

5.2.5 Area E: Building 95 Area

5.2.5.1 Site 22 — Impoundments near Building 95

Closure Plan

The revised RCRA closure plan includes the following proposed actions:

- Test holes will be drilled through the center of the closed old sludge drying basin and two sand filter lagoons and into the upper aquifer; composite soil samples will be collected over 0.6-m (2-ft) intervals. In addition, two core samples will be taken from the locations outside and downgradient from the lagoon, and eight shallow soil samples will be collected to a depth of 0.3 m (1 ft) from random locations downgradient from the lagoon.
- The soil samples (a total of about 25) will be analyzed for pH, total organic carbon (TOC), total organic hydrocarbons (TOH), conductivity, and priority pollutant metals. If TOC and TOH concentrations exceed background levels, then the soil will be tested for the volatile organic portion of the priority pollutants analysis.

- If tests on the soil samples reveal that the soil below these impoundments is not contaminated, then the cleanup of the lagoon area at the 1981 closure can be considered complete.

- If soil samples indicate that soils below and downgradient of these impoundments are still contaminated, the contaminated soil will be excavated until clean soil is reached. The contaminated soil will be disposed of at permitted facilities, and the excavation pits will be backfilled with clean fill, resurfaced with top soil, and seeded.

- The exact location of underground pipelines on the Site will be determined by using appropriate, commercially available pipe location techniques. Four soil samples will be randomly collected from locations under the pipes and analyzed for pH, TOC, total organic halogens (TOX), conductivity, and priority pollutant metals. If the soil under the pipelines is contaminated, then both the piping and soil will be removed by excavation and disposed of properly. Excavation of soil will continue until clean soil is reached. The excavation will then be restored to prevent soil erosion. If the soil under the pipelines is not contaminated, these pipelines will be cleaned and then capped.

- An ongoing groundwater monitoring program by USGS will be continued for this area. The new monitoring wells drilled in summer 1989, which are completed in the unconfined glacial aquifer, and all other wells at the Site will be sampled for analysis of trace metals, common constituents, explosive compounds, and VOCs. In addition, about 15% of the wells will be sampled for analysis of base/neutral and acid extractable compounds, pesticides, and PCBs. Water levels will be measured in all wells to develop maps of the water table elevation.

Proposed RI Plan

No additional sampling is proposed for this Site. If clean closure is not possible, then additional work may be needed.

5.2.5.2 Site 28 — Sewage Treatment Plant Sludge Beds

Phase I

- Check the units in the sewage treatment plant for subsurface leakage.

- Collect sewage samples and sludge samples (from the secondary settling tanks in the existing plant).

- Analyze the samples to determine whether they contain excessive levels of contaminants generally not present in sewage, including TCL metals, TCL volatiles, TCL semivolatiles, and PCBs.

Phase II

- Install a well cluster between the sewage treatment plant and Green Pond Brook.

- Include the new well cluster in the groundwater monitoring program for Site 22.

5.2.5.3 Site 38 — Building 95, Plating and Etching Wastewater Treatment System

Closure Plan

The revised closure plan calls for the interim closure of unused underground tanks T-1, T-2, and T-7 by removing the contents, washing the tanks with water, flushing and removing all associated piping, etc., and closing the tanks in place by filling them with an inert material. Two rinsate samples will be collected per tank; one concrete core sample and one underlying soil sample will be collected from underneath each of the tanks. The rinsate and core samples will be analyzed for priority pollutant metals, and the soil samples will be analyzed for priority pollutant metals, halogenated VOCs, and, if necessary, EP toxicity for metals.

Proposed RI Plan

Phase I

- Close tanks T-3 through T-6, T-8, and T-9 as soon as possible. Implement the sampling specified in the closure plan for tanks T-1, T-2, and T-7 and collect additional samples as described below.

- Collect six grab samples from the tanks and six soil samples from beneath the tanks.

- Analyze the grab and soil samples for all TCL parameters, cyanide, and TCLP leachability.

Phase II

If the soil samples are found to be contaminated, collect additional soil and groundwater samples.

5.2.5.4 Site 44 — Building 39, Golf Course Maintenance Shop

Closure Plan

Revised RCRA closure plans include inspection of the building and surrounding areas, and collection of one soil sample from under the pallet storage area. The sample will be analyzed for petroleum hydrocarbons, VOCs, priority pollutant metals, herbicides, pesticides, and, if necessary, EP toxicity for metals. If the sample shows contamination, one soil boring will be drilled in the area.

Proposed RI Plan

Phase I

- Inspect the underground gasoline tank next to the building. If the tank leaks, collect two soil samples from underneath the tank and analyze them for TCL volatiles and TCL semivolatiles.

- Collect six air quality samples in the area around the building.

- Analyze the air samples for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, herbicides, and asbestos.

Phase II

- Collect subsurface soil samples at the locations known to be contaminated with pesticides to delineate the extent of contamination.

- Develop a cleanup plan.

5.2.6 Area F: Propellant Area

5.2.6.1 Site 60 — Building 163, Photography Laboratory

Closure Plan

The revised RCRA closure plan for the underground storage tank near the building includes collecting one sample of the tank contents and analyzing it for priority pollutant metals, VOCs, and cyanide. The tank and piping will be emptied, cleaned, and removed. Six soil samples will be collected and analyzed for priority pollutant metals, VOCs, cyanide, and EP toxicity for metals. One or two condensate or rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the building and area around it for signs of contamination. Do nothing further if the area is clean.
- Collect one surface soil sample from each area of stained soil.
- Analyze the soil and chip samples for cyanide and TCL metals.

Phase II

Drill one soil boring in each area of soil contamination identified by the Phase I results. Additional soil and water samples may be needed to determine the extent of contamination, if any, found by the Phase I results.

5.2.6.2 Site 61 — Buildings 171 and 176, Photographic and Propellant Processing

Closure Plan

The revised closure plan includes decontaminating the building and equipment. Two wash water or rinsate samples and two chip samples will be collected and analyzed for priority pollutant metals. Six soil samples will be collected and analyzed for priority pollutant metals, VOCs, cyanide, and, if necessary, EP toxicity for metals.

Proposed RI Plan

Phase I

- Inspect the areas around the buildings to locate areas of visible contamination or dumping. Inspect the photographic chemical containers stored in the shed behind Bldg. 176 for signs of leakage.
- Collect one surface soil sample from the center of each visibly contaminated area outside the buildings.
- Collect four surface soil samples behind Bldg. 171.
- Collect one sediment sample from each drain outfall from Bldg. 171, and collect two surface water samples and two sediment samples from the creek south of Bldg. 171.
- Analyze the above soil, water, and sediment samples for cyanide, propellants, and TCL metals.
- Collect one surface soil sample from each side of Bldg. 176.
- Analyze the Bldg. 176 surface soil samples for cyanide and TCL metals.
- Collect four surface water samples and four sediment samples to a depth of 0.6 m (2 ft) from the swamp between Bldgs. 176 and S406.
- Analyze the surface water and swamp sediment samples for TCL metals, propellants, and explosives.

Phase II

- Drill one soil boring in the center of each contaminated area identified by the Phase I surface soil analyses. Samples should be analyzed for parameters found at significant contamination levels in the Phase I results.
- Collect additional sediment and soil samples and install monitoring wells if warranted by the Phase I analyses and soil boring results.

5.2.6.3 Site 104 — Buildings 161 and 162, Chemical Laboratories

Phase I

- Conduct a field inspection in the areas around the buildings to locate propellant dumping areas and the lime pit. If the lime pit cannot be located, conduct a geophysical survey to locate the pit. Visually inspect the swamp, creek, and building interiors for signs of contamination.

- Collect surface soil samples to a depth of 0.6 m (2 ft):

  - One sample from each area outside the buildings with signs of contamination.

  - One sample from each identified propellant or chemical dump.

  - One sample from each side of each building (eight samples).

- If the lime pit is located, drill one soil boring in its center and collect soil samples from the top, pit bottom, and bottom of the boring.

- Collect surface water and sediment samples to a depth of 0.3 m (1 ft):

  - Three water and three sediment samples from the swamp behind Bldg. 162.

  - One water and one sediment sample from the creek downgradient from the buildings.

  - One sediment sample from each outfall of building drain.

- Analyze all the samples for TCL volatiles, TCL semivolatiles, TCL metals, propellants, explosives, nitrates, and sulfates.

Phase II

- Drill one soil boring from the surface to the water table in the center of each area of significant contamination identified by the Phase I analyses. Collect soil samples over 0.6-m (2-ft) intervals from each boring.

- Analyze the soil boring samples for contaminants with elevated concentrations in the Phase I samples.

- Install at least one monitoring well downgradient from the lime pit site, if the surface soil samples and soil boring samples show contamination.

Phase III

Collect additional soil, sediment, and water samples to delineate the extent of the contamination, depending on the Phase II results.

5.2.6.4 Site 106 — Building 1010, Propellant Plant

Phase I

- Visually inspect the location of Bldg. 1010 (which was destroyed under TECUP) and the transformer storage area for signs of contamination.

- Collect one surface soil sample over a depth of 0.15-0.3 m (6-12 in.) from each side of the building's former location and transformer storage area (a total of eight samples) and from the center of each visibly contaminated area.

- Analyze the samples for propellants, PCBs, and nitrates.

Phase II

- Collect additional surface soil samples if warranted by the results of the Phase I analyses.

- Drill one soil boring in the center of each significantly contaminated area identified during Phase I. (Avoid the asbestos burial area.) Collect at least two soil samples from each boring.

5.2.6.5 Site 111 — Buildings 454 and 455, Propellant Bag Filling Area

Phase I

- Inspect the areas around the buildings for signs of contamination and drain outfalls.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each area with visible contamination.

- Collect two surface soil samples to a depth of 0.6 m (2 ft) from the Bldg. 454 loading areas and collect one surface soil sample (to the same depth) from each side of Bldgs. 455 and 454 (eight samples).
- Collect one sediment sample to a depth of 0.6 m (2 ft) from the outfall of each building drain located during the inspection.
- Analyze all samples for propellants.

Phase II

Collect additional surface soil samples and drill soil borings if areas of significant contamination are identified by the Phase I results.

5.2.6.6 Site 124 — Building 166, Propellant Testing

Phase I

- Inspect the area around the building for signs of contamination. Do nothing further if the area is clean.
- Collect one soil sample from each visibly contaminated area outside the building.
- Analyze all samples for propellants and explosives.
- Prepare a composite sample from three soil samples taken from three areas near the PCB transformer at the building.
- Analyze the composite sample for PCBs.

Phase II

- Drill one soil boring to the water table at each contaminated area and collect soil samples from each boring.
- Analyze the boring samples for propellants and explosives.

5.2.6.7 Site 125 — Buildings 172 and 183, Office Building and Lubricant Testing

Phase I

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one soil sample from each side of the two buildings (at least eight samples altogether).
- Analyze all samples for TCL semivolatiles, TCL metals, nitrates, and sulfates.
- Prepare two composite samples, each from three soil samples (to a depth of 0.15 m) collected in areas near each of the two PCB transformers of Bldg. 183.
- Analyze the composite samples for PCBs.

Phase II

Determine the need for additional sampling based on the Phase I analyses.

5.2.6.8 Site 126 — Building 197, Propellant Testing

Phase I

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the building.
- Analyze all samples for propellants.

Phase II

- If contamination is found in the surface soil samples, drill one soil boring in the center of each contaminated area and collect samples from each boring.

- Analyze the boring samples for the contaminants found in the Phase I samples.

5.2.6.9 Site 138 — Buildings 404, 407, and 408, Chemical Laboratory and Propellant Plants

Phase I

- Inspect drains, drain outfalls, and the areas around the buildings for signs of contamination.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one surface soil sample to a depth of 0.6 m (2 ft) from each side of each building (12 samples).

- Collect sediment and surface water samples:

  - One sediment sample at the outfall of each drain from the buildings.

  - One sediment sample from each settling tank of Bldg. 408.

  - Two surface water and two sediment samples from the nearby swamp.

- Collect two drive-point water samples from each of three different areas (a total of six samples) downgradient of the buildings.

- Analyze the soil, water, and sediment samples for nitrates, TCL metals, TCL volatiles, TCL semivolatiles, explosives, and propellants.

- Prepare a composite sample from either three soil samples (to a depth of 0.15 m) or chip samples in three areas near the PCB transformers of Bldg. 404.

- Analyze the composite sample for PCBs.

Phase II

- Collect surface water samples and additional soil samples if significant contamination is indicated by the Phase I analyses.

- Install two shallow monitoring wells downgradient to monitor groundwater if warranted by the soil, sediment, and surface water analyses.

- Analyze the groundwater samples for TCL metals, TCL volatiles, explosives, and propellants.

5.2.6.10 Site 139 — Building 424, Propellant Processing

Phase I

- Conduct a field inspection to locate the reported decontamination pits and slurry pipeline. Use geophysical methods if necessary.

- Collect soil samples from each pit located by the inspection:

  - If the pit bottoms are visible, collect one soil sample from the bottom of each.

  - If the pits are covered, drill one soil boring to a depth at least 1.8 m (6 ft) below the bottom of each pit. Collect samples from the top, pit bottom, and bottom of each boring.

- Collect two sediment samples to a depth of 0.3 m (1 ft) from the swamp behind the building.

- Analyze all samples for propellants.

Phase II

- If contamination is indicated by the Phase I analyses, drill one soil boring in each area of contaminated soil or sediment sampling. Collect samples from each boring and analyze for contaminants found in the Phase I samples.

- Additional groundwater sampling may be needed to determine the extent of contamination.

5.2.6.11 Site 140 — Buildings 427 and 427B, Propellant Processing

Phase I

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one surface soil sample from each side of Bldg. 427.
- Collect two sediment samples to a depth of 0.3 m (1 ft) in the open drain around the buildings, two sediment samples from any two inlets of the open drain, and one sediment sample from the concrete pit of Bldg. 427B.
- Analyze all samples for propellants and explosives.
- Collect one grab sample from each catch tank in Bldg. 427.
- Analyze the grab sample for TCL volatiles, TCL semivolatiles, acetone, ethyl acetate, propellants, and explosives.

Phase II

If contamination is indicated by the Phase I analyses, collect additional groundwater and soil samples.

5.2.6.12 S'te 141 — Building 429, Propellant Crushing

Phase I

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area.
- Analyze the surface soil samples for propellants.
- Collect one sediment sample from the catch tank in Bldg. 429.
- Analyze the sediment sample for TCL metals, TCL volatiles, TCL semivolatiles, and propellants.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses.

5.2.6.13 Site 142 — Building 435, Propellant Solvent Mixing

Closure Plan

The revised RCRA closure plan includes removal of hazardous wastes and decontamination of the building and equipment. Two chip samples and two wash water or condensate samples will be collected and analyzed for priority pollutant metals. After decontamination, equipment will be removed and disposed of and the building will be demolished.

Proposed RI Plan

Phase I

- Inspect the area around the building for visible contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each area with signs of contamination.
- Collect one sediment sample from the outfall of each building drain outlet located during the inspection.
- Analyze the soil and sediment samples for propellants, nitrates, chlorides, ethyl acetate, and acetone.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

5.2.6.14 Site 143 — Building 436, Propellant Processing

Phase I

- Inspect the area around the building for signs of contamination.

- Collect one surface soil sample to depth of 0.3 m (1 ft) from each visibly contaminated area.
- Collect one sediment sample to a depth of 0.3 m (1 ft) from the outfall of each drain located during the inspection.
- Analyze all samples for propellants.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

5.2.6.15 Site 144 — Building 462, Propellant Processing

Phase I

- Conduct a field inspection to locate signs of contamination outside the building, to locate drains and drain outfalls, and to inspect any waste cans for leaks.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the building.
- Collect one sediment sample from each located drain or drain outfall.
- Analyze the soil and sediment samples for explosives and propellants.

Phase II

- If contamination is found in the outfalls of any drains, install two monitoring wells in two different areas downgradient from the building. Sample the well for two quarters.
- If contamination is found in the soil samples, determine the need for additional surface or subsurface soil samples.

5.2.6.16 Site 145 — Building 477, Explosive and Propellant Mixing

Phase I

- Conduct a field inspection around the building to locate areas with signs of contamination, the reported sand filter, drains, drain outfalls and any of the reported waste dumping areas.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of any located area of waste dumping and each area with signs of contamination. Collect one surface soil sample to a depth of 0.6 m (2 ft) from each side of the building.
- Collect two sediment samples from the bottom of the sand filter (if it is located) and collect two sediment samples to a depth of 0.3 m (1 ft) from each drainage receiving filter effluent.
- Collect one sediment sample from each building drain outfall located by the inspection.
- Analyze all soil and sediment samples for TCL metals, propellants, and explosives.

Phase II

- If any of the sediment samples collected from filter effluent areas or drains contain significant contamination, install one well between the building and brook.
- Collect water samples for two quarters and analyze for contaminants found in the Phase I samples.
- If the soil samples contain significant contamination, determine the need for additional surface and subsurface soil sampling.

5.2.6.17 Site 146 — Building 497, Powder Pressing

Phase I

- Conduct a field inspection to locate signs of contamination.
- Collect four surface soil samples to a depth of 0.15 m (6 in.), one from each side of the building. If possible, collect one soil sample from each of two locations under the building.

- Collect one sediment sample from each ditch or drain outfall around the building (if any exist) and from any drainage receiving effluent from the building.
- Analyze the soil and sediment samples for propellants.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

5.2.7 Area G: DRMO Yard and Surroundings

5.2.7.1 Site 31 — Buildings 314 and 314B-314E, Defense Reutilization Marketing Office

Phase I

- Inspect area surrounding Bldgs. 314B, 314C, 314D, and 314E for visible contamination. Collect surface soil samples from each stained area and one from each loading and handling area.
- Analyze the surface soil samples for TCL compounds.
- Drill eight soil borings to the water table, one each at the soil sampling locations SS31-1 through SS31-6, SS31-8, and SS31-10.
- Analyze the soil boring samples for all TCL parameters.

Phase II

Install groundwater monitoring wells if warranted by the results of the soil boring program.

5.2.7.2 Sites 52 and 95 — Petroleum Leak Area (near Building 305) and Building 336

Brook Area

Phase I

- Collect 10 surface soil samples at depths of 0.15-0.3 m (6-12 in.) in an even distribution across the brook area.

- Analyze the samples for all TCL parameters except dioxin.

Phase II

Drill soil borings if warranted by the results of the soil sampling.

Swampy Area

Phase I

- Drill soil borings to 3 m (10 ft) or groundwater in (1) the location of Bldg. 336 and (2) all areas where previous surface soil samples contained elevated contaminant concentrations. Collect samples from the top, middle, and bottom of each core.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

Phase II

Install upgradient and downgradient monitoring wells if warranted by the results of the soil boring program.

Former Pond Bed

Phase I

- Drill soil borings to 3 m (10 ft) or groundwater in all areas where previous surface soil samples contained elevated contaminant concentrations. Collect samples from the top, middle, and bottom of each core.

- Analyze the samples for all TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

Phase II

Install upgradient and downgradient monitoring wells, if warranted by the results of the soil boring program.

5.2.7.3 Site 96 — Buildings 301 and 301A

Phase I

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.

- Collect one soil sample from each stained area.

- Collect one surface soil sample from each side of each building and one sample from three locations in each storage area. Collect the samples between 0.15 and 0.3 m (6 and 12 in.) deep. If storage areas are paved, drill through the pavement to obtain samples.

- Analyze all samples for TCL volatiles, TCL semivolatiles, and PCBs.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.7.4 Site 101 — Buildings 311 and 319

Phase I

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways. Inspect the area around Bldg. 311 for signs of disposal activities. Carry out a geophysical survey to locate disposal pits (if any).

- If disposal pits are found, collect six or more surface soil samples between 0.15 and 0.3 m (6 and 12 in.) deep from the pit area.

- Collect one surface soil sample from ten locations between 0.15 and 0.3 m (6 and 12 in.) deep in the reported burning ground area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and TCL metals.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.7.5 Site 134 — Building 302

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Conduct a geophysical survey around building to locate the disposal pit.

- If the pit is found, collect three hand-auger samples to a depth of 0.6 m (2 ft) in the pit area. If the pit is paved over, drill through the pavement to obtain samples.

- Collect one soil sample from each area of stained soil.

- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each storage area. Drill through pavement if necessary.

- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.7.6 Site 135 — Building 315

Phase I

- Inspect the Site and surrounding area for visible contamination.

- Collect one surface soil sample from each stained area.

- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, and sulfate.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.7.7 Site 136 — Building 355

Phase I

- Inspect the Site and surrounding area for visible contamination.
- Collect one surface soil sample from each area.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, and sulfate.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8 Area H: Munitions Assembly

5.2.8.1 Site 55 — Building 225, Explosives Machining Facility

Phase I

- Collect soil samples at four locations: (1) underneath the raised flow trough between Bldgs. 225 and 232 at 3-m (10-ft) intervals, (2) around the perimeters of Bldgs. 221, 223, and 225 (two samples from each side of each building [24 total]), (3) around the holding tank in Bldg. 225 if possible, and (4) under the discharge point in Bear Swamp Brook at each corner and in the center of a 4.6- by 6-m (15- by 20-ft) area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, nitrate, nitrite, and explosives.

Phase II

Install groundwater monitoring wells if warranted by the results of the soil sampling program.

5.2.8.2 Site 62 — Building 210

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate any drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Collect two surface water and sediment samples from the former outfall location in Bear Swamp Brook.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant soil contamination.
- Analyze the samples for parameters found to have elevated concentrations by the Phase I analyses.
- Install one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.3 Site 64 — Building 241

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.

- Collect two surface water and sediment samples from the location of the former outfall in Bear Swamp Brook.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

Phase II

- Drill one soil boring to the shallower of the water table or 3.0 m (10 ft) in each area of significant surface soil contamination.

- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring program.

5.2.8.4 Site 98 — Building 268

Phase I

- Inspect the building and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table, whichever comes first, in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated levels in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.5 Site 100 — Building 276

Phase I

- Review DEH records to find the former location of Bldg. 276 (which was destroyed under TECUP) and determine the positions of loading docks and doors. Inspect these areas for visible contamination and signs of disposal.
- Collect one surface soil sample from each visibly contaminated area.
- Collect one surface soil sample from ten locations between 0.15 and 0.3 m (6 and 12 in.) deep at the building's former location. Use building plans to locate samples.
- Collect two surface water and sediment samples from Bear Swamp. Sampling locations should be in areas near the building.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and PCBs.

Phase II

- Drill one soil boring 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.6 Site 127 — Building 230

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of the building.
- Analyze all samples for explosives, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.7 Site 128 — Buildings 235 and 236

Phase I

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of each building (eight perimeter samples altogether).
- Analyze all samples for explosives, nitrate, and nitrite.

Phase II

- Drill one soil boring to the water table or 3 m (10 ft) in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.8 Site 129 — Building 240

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways. Search PTA records and interview knowledgeable personnel about past uses of Bldg. 240.
- Develop and implement a sampling plan if warranted by the results of the inspection and records search.

Phase II

Determine the need for further action if sampling shows the presence of contamination.

5.2.8.9 Site 130 — Building 252

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of the building.
- Analyze all samples for explosives, propellants, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.10 Site 131 — Building 266

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.11 Site 132 — Buildings 271 and 271I-271N

Closure Plan

The revised RCRA closure plan for Bldg. 271I includes analyzing one grab sample from each container for the parameters listed in the closure plan. Also, seven chip samples and two grab samples of wash water or condensate will be analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect four surface soil samples from the perimeter (one from each side) of each building.
- Analyze all samples for TCL metals, explosives, propellants, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.8.12 Site 151 — Building 600

Phase I

- Visually inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from each side of the building and from the center of each area of visible contamination.
- Analyze the samples for propellants and explosives.

Phase II

- If significant contamination is found, drill one soil boring in the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for the contaminants found in the Phase I samples.

5.2.9 Area I: Around Picatinny Lake

5.2.9.1 Site 16 — Guncotton Line

- Consult knowledgeable personnel of ARDEC before characterizing the line or making decisions about its disposition.
- The location of 80% of the length of the guncotton line is known. Use dye tracer tests to locate the remainder of the line. Assess the integrity of the line.
- Assess the feasibility of removing the line based on the explosives removal methods developed by the Army.
- During any excavation of the line or associated portions, collect samples of surrounding soil and analyze them for explosives.

5.2.9.2 Site 30 — Building 3045, Fluorochemicals Storage

Closure Plan

Revised RCRA closure plans for Bldg. 3045 include collecting two rinsate samples and two chip samples from the cleaned floor and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Collect four surface soil samples to a depth of 0.15 m (6 in.) at the following locations: one sample by the building doorway, one sample along each of the two sides of the building, and one sample from the roof near the vent (only if soil is present).
- Analyze the samples for TCL metals, TCL volatiles, TCL semivolatiles, herbicides, chloride, fluoride, bromide, nitrate, and nitrite.

Phase II

- Collect additional soil samples if significant contamination is found in the surface soil samples. Drill soil borings if they are needed to determine the depth of contamination.
- Install two monitoring wells (one upgradient and one downgradient of the building) if warranted by the results of the surface soil sampling in Phase I.

5.2.9.3 Site 32 — Storage Tanks at Building 553

Closure Plan

Revised RCRA closure plans for the 11 tanks include air bomb or liquid sampling of each tank, followed by water flushing and steam cleaning. One steam condensate grab sample will be collected for each tank. The samples will be analyzed for nitrates, VOCs (liquid samples only), and priority pollutant metals (condensate samples only).

Proposed RI Plan

Phase I

- Collect 14 surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.), one under each filling or discharge point for each tank (11 samples altogether) and three along the northwest side of Bldg. 553 and by the pipeline.

- Collect three or more surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) under the pipeline at points of soil staining or under joints and valves if no staining is present.

- Analyze the samples for TCL volatiles, TCL semivolatiles, nitrocellulose, nitrate, and nitrite.

Phase II

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

5.2.9.4 Site 33 — Storage Tanks at Building 527A

Closure Plan

Revised RCRA closure plans for the Site include collecting air bomb and liquid samples of the tank contents followed by flushing out the tanks with water and then steam cleaning. Two steam condensate samples will be collected from the tanks and 16 soil samples will be collected at two depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) at 8 locations from the area under the two tanks. The samples will be analyzed for nitrates (0-6 in. soil and liquid samples only), VOCs (6-12 in. soil and liquid tank samples only), priority pollutant metals (0-6 in. soil and condensate samples only), and, if necessary, EP toxicity for metals (soil samples only).

Proposed RI Plan

Phase I

- Collect two surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) from locations half-way between the building and Picatinny Lake.

- Analyze samples for TCL volatiles and explosives.

Phase II

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the Phase I results.

5.2.9.5 Site 40 — Buildings 809 and 810, Explosives Manufacturing Wastewater Treatment Facility

Closure Plan

Revised RCRA closure plans for Bldg. 809 include collecting wipe samples from the cleaned floor and analyzing them for nitrates and EP toxicity (metals). Surface soil samples will be collected from five locations and analyzed for priority pollutant metals, nitrate, and EP toxicity for metals. Subsurface soil samples will be collected from the same locations and analyzed for VOCs.

Revised closure plans for the holding tank outside Bldg. 810 include collecting surface and subsurface soil samples at four locations around the tank pad and analyzing them for priority pollutant metals, nitrates, and EP toxicity for metals. Subsurface samples will be collected from the same locations and analyzed for VOCs.

Proposed RI Plan

Phase I

- Collect six surface soil samples to a depth of 0.15 m (6 in.) as follows: three from the drainage ditch, two along the lake shore, and one from sediments in the drainage pipe.
- Collect surface soil samples from areas of soil disturbance, soil staining, or possible spills. Examine the area between Bldgs. 809 and 810, where the possible existence of a pit was reported.
- Analyze all surface soil and sediment samples for herbicides, explosives, TCL metals, nitrate, and nitrite.

Phase II

Collect additional surface soil samples and drill soil borings if warranted by the results of the Phase I surface soil and sediment sampling programs.

5.2.9.6 Site 46 — Building 507, 90-Day Waste Accumulation Area

Closure Plan

The revised RCRA closure plan includes removal of hazardous wastes and steam cleaning the building and shed. Two chip samples and two wash water or condensate grab samples will be collected and analyzed for priority pollutant metals. Three soil samples will be collected and analyzed for priority pollutant metals, VOCs, total petroleum hydrocarbons (TPH), and if necessary EP toxicity for metals. Soil borings will be drilled and additional surface and subsurface soil samples collected to delineate the extent of contamination if it is found.

Proposed RI Plan

No additional activities are proposed unless the soils are contaminated, in which case surface water and groundwater monitoring would be needed.

5.2.9.7 Site 47 — Buildings 3005 and 3006, 90-Day and Satellite Waste Accumulation Areas

Closure Plan

Revised RCRA closure plans for Bldg. 3005 include collecting soil samples from two different depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) from one location under the pallet storage area. The shallow sample will be analyzed for priority pollutant metals, and the deeper sample will be analyzed for VOCs, TPH, and EP toxicity for metals.

Proposed RI Plan

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- If no visible contamination is found, collect at least three samples from around the edge of the storage area behind Bldg. 3005.

- Analyze all samples for PCBs, oil and grease, TCL volatiles, and TCL semivolatiles.

Phase II

Collect additional soil samples if warranted by the Phase I results.

5.2.9.8 Site 50 — Buildings 519 and 519A, Still House and Alcohol Storage

Closure Plan

Revised RCRA closure plans have been prepared for Bldg. 519A. Since the tanks, which stored alcohol, have already been removed, activities are limited to collecting 12 soil samples at two depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) from six locations in the area where the tank was located. The shallow samples will be analyzed for priority pollutant metals, nitrates, and, if necessary, EP toxicity for metals, and the deeper samples for VOCs.

Proposed RI Plan

Phase I

- Inspect the area around Bldgs. 519 and 519A for soil staining or other signs of visible contamination. Locate any sumps or weirs inside or outside either building.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of each visibly contaminated area. Collect one surface soil sample from each side of Bldg. 519 (four samples). This is in addition to the samples collected in the closure sampling plan.

- Collect one sediment sample from each sump or weir located during the inspection.

- Analyze all samples for explosives, TCL volatiles, TCL metals, and TCL semivolatiles.

Phase II

- Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

- Install groundwater monitoring wells if warranted by the soil boring results.

5.2.9.9 Site 53 — Picatinny Lake

Phase I

- Collect soil samples from the island in the lake to a depth of 0.15 m (6 in.) at locations on a regular 30-m (100-ft) grid and in any areas of soil staining, in areas of little or no vegetative growth, and around building exits.

- Analyze the soil samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

- Make a strong effort to locate UXO, containers of explosives, and other dangerous items on the lake bottom. Use techniques such as geophysical surveying, scanning with underwater television cameras, and those available to explosive ordnance demolition (EOD) teams (including classified methods).

- Remove or mark (with buoys) any dangerous items that are located.

- Give consideration to *slow* drainage of the lake to expose the bottom for sampling, cleanup, and removal of dangerous items.

- Collect water and sediment samples from 10 or more locations in Picatinny Lake. The water samples should be averages over the water column and the sediment samples should be core samples to a depth of 0.3 m (1 ft) in the lake bottom.

- Analyze the water and sediment samples for TCL metals, TCL volatiles, TCL semivolatiles, explosives, pesticides, PCBs, Mirex, herbicides, fluoride, cyanide, nitrate, nitrite, gross alpha, gross beta, and macroparameters (water samples only).

Phase II

- Drill soil borings and install monitoring wells on the island if warranted by the results of the surface soil sampling program.

- Collect additional surface water and sediment samples from Picatinny Lake if warranted by the results of the Phase I sampling program. If elevated gross alpha or gross beta activities are found

in the Phase I samples, analyze additional samples to identify the radionuclides responsible for the activity.

- Quarterly monitor surface water at locations near any dangerous items that are located but not removed (and presumably marked with buoys). Parameters to monitor are explosives, TCL metals, TCL volatiles, nitrate, nitrite, fluoride, and any other parameter detected in the water or possibly present in the nearby dangerous item. Monitoring for the same parameters is also needed near any drinking water intakes.

5.2.9.10 Site 63/65 — Building 506

Closure Plan

Revised RCRA closure plans for Bldg. 506 include collecting two chip samples, two condensate grab samples, and three soil samples each from the storage and burning system pads. All samples will be analyzed for priority pollutant metals; the condensate and soil samples will be analyzed for EP toxicity for metals; and the soil samples will be analyzed for VOCs, TPH, and PCBs.

Proposed RI Plan

Phase I

- Visually inspect the waste oil storage pad and surrounding area to locate signs of contamination.

- Drill one soil boring in the center of each visibly contaminated area near the pad to a depth of 0.9-1.5 m (3-5 ft). Also drill one boring between the pad and Picatinny Lake, 16 m (50 ft) away from the pad.

- Analyze the samples for TCL volatiles, TCL semivolatiles, TCL metals, oil and grease, and PCBs.

Phase II

Determine the need for additional sampling based on the results of the Phase I sampling.

5.2.9.11 Site 70 — Buildings 3028 and 3029

Phase I

- Inspect the exteriors and areas around the buildings for signs of contamination. Also inspect areas near the acid treatment pit and sewage lift station at Bldg. 3028. Do nothing further if the areas appear to be clean.

- Collect one surface soil sample at a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.

- Analyze the samples for explosives, TCL volatiles, TCL semi-volatiles, and TCL metals.

Phase II

- If significant contamination is found in the surface soil samples, drill one soil boring near each contaminated area and collect samples.

- Analyze the boring samples for explosives, TCL metals, TCL volatiles, and TCL semivolatiles.

Phase III

Determine the need for monitoring wells based on the results of the soil boring sampling program.

5.2.9.12 Site 71 — Building 910

Closure Plan

The revised RCRA closure plans for Bldg. 910 include sealing off the building, washing and removing equipment, and steam cleaning the building. Two grab wash water or rinsate samples and four chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the perimeter of the building for signs of soil staining, spills, or waste disposal.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area identified by the inspection.
- Analyze the samples for propellants, explosives, and TCL metals.

Phase II

- If significant contamination is found in the surface soil samples, drill at least two soil borings between Bldg. 910 and Picatinny Lake and near the contaminated area and collect samples from each boring.
- Analyze the boring samples for propellants, explosives, and TCL metals.

Phase III

- If subsurface soils are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near each contaminated boring.
- Analyze the sediment samples for the contaminants found in the soil boring samples.

5.2.9.13 Site 79 — Building 3013

Closure Plan

Revised RCRA closure plans for Bldg. 3013 include sealing off and steam cleaning the building and collecting two rinsate grab samples and two chip samples. The samples will be analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the building perimeter for any areas of visible contamination.

- Collect three surface soil samples to a depth of 0.3 m (1 ft) near the southwest corner of the building and from any visibly contaminated areas located by the inspection.

- Analyze the samples for TCL volatiles and TCL semivolatiles.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring near each contaminated area and collect samples from each boring.

- Analyze the boring samples for TCL volatiles and TCL semivolatiles.

Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

5.2.9.14 Site 82 — Building 908

Phase I

- Locate the original outflow line and outfall point for the silver recovery unit. Use a visual inspection, detailed maps, or geophysical techniques as necessary.

- If the outflow line is located, collect three surface soil samples to a depth of 0.3 m (1 ft), two along the path of the line and one from the discharge point.

- Analyze the samples for silver and TCL semivolatiles.

Phase II

- If significant silver concentrations are found in the samples, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near the contaminated sampling locations.

- Analyze the sediments for silver and TCL semivolatiles.

5.2.9.15 Site 83 — Building 3022

Closure Plan

The revised RCRA closure plan for Bldg. 3022 includes sealing off and steam cleaning the building and equipment. Two rinsate grab samples and 36 chip samples (two from each lab) will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area around the building for soil and surface contamination and to locate the acid pit and drain lines. Geophysical methods may be needed.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.

- Analyze the samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

- If the pit is exposed, collect surface soil samples to a depth of 0.3 m (1 ft) from the drain outfall and pit bottom. If the pit is covered, drill one soil boring in the center of the pit and collect samples at 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the bottom of the boring.

- Analyze pit samples for explosives, propellants, TCL metals, nitrate, nitrite, and sulfate.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area and collect samples from each boring.
- Analyze the boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase III

Install monitoring wells if significant subsurface contamination is found in the boring samples. Determine the number and location of wells based on the results of the soil boring program.

5.2.9.16 Site 90 - Building 329

Closure Plan

Revised RCRA closure plans for Bldg. 329 include collecting two chip samples and two grab samples of wash water or rinsate and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the building and surrounding area for visible contamination.
- Collect one soil sample from each area with visible staining.
- Analyze the samples for TCL volatiles and TCL semivolatiles.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant soil contamination. Collect samples from each boring.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.9.17 Site 93 — Buildings 800 and 807

Phase I

- Locate the reported pits behind Bldg. 800 and the reported powder disposal area behind Bldg. 807. Use a visual inspection, detailed maps, or geophysical methods as necessary.

- If the pits are located, drill one soil boring in the center of each pit. Collect at least two samples from each boring over 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the bottom of each boring.

- If the powder disposal area is located, collect two surface soil samples to a depth of 0.3 m (1 ft) from the center of the area.

- Analyze all samples for propellants and explosives.

Phase II

- If the Phase I samples are significantly contaminated, drill two soil borings, one between each building and Picatinny Lake. Collect samples from each boring.

- Analyze the boring samples for propellants and explosives.

Phase III

- If the Phase II boring samples are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the lake near the soil boring locations.

- Analyze the sediment samples for propellants and explosives.

5.2.9.18 Site 97 — Building 501

Phase I

- Visually inspect the area around Bldg. 501 for signs of soil contamination.

- Collect one surface soil sample from each visibly stained area and from each side of the building to a depth of 0.15 m (6 in.).

- Analyze the samples for TCL semivolatiles and mercury.

Phase II

Collect additional soil samples if warranted by the results of the Phase I analyses.

5.2.9.19 Site 102 — Building 3050

Phase I

- Inspect the area to locate the car rack and any areas of oil dumping, soil staining, or inhibited vegetative growth.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area identified by the inspection.

- Analyze the surface soil samples TCL volatiles, TCL semivolatiles, and lead.

- Drill one soil boring at the center of the car rack area and collect samples from the boring.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and lead.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and lead.

Phase III

Determine the need for monitoring wells based on the results of the Phase II sampling program.

5.2.9.20 Site 105 — Building 511

Phase I

- Visually inspect the location of Bldg. 511 (which was destroyed under TECUP) for signs of contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) within 50 ft of each side of the former building location and from the center of each visibly contaminated area.
- Analyze the samples for PCBs.

Phase II

Collect additional surface soil samples, drill soil borings, and install monitoring wells if warranted by the results of the Phase I analyses.

5.2.9.21 Site 108 — Buildings 717, 722, and 732

Closure Plan

The RCRA closure plan for Bldg. 722 includes collecting rinsate grab samples, wipe samples, and core and soil boring samples from the hearth floor after residues are removed and the building is cleaned. The samples will be analyzed for EP toxic metals.

Proposed RI Plan

Phase I

- Inspect the area to locate areas of reported freon dumping and possible flare activities.
- If such areas are found, collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area.

- Collect two surface soil samples along the perimeters of Bldgs. 722 and 723 (four samples altogether) and collect one soil sample at the air inlet for the trench in the Bldg. 722 flare testing room.
- Analyze the above soil samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.
- Collect four surface soil samples from the perimeter of Bldg. 717.
- Analyze the Bldg. 717 samples for TCL metals.
- Collect two samples from the concrete pit.
- Analyze the pit samples for explosives, TCL metals, and fluoride.

Phase II

- If the surface soil samples are significantly contaminated, drill three soil borings, one each between Bldgs. 717 and 722 and Picatinny Lake and one between Bldg. 722 and Green Pond Brook. Collect samples from each boring.
- Analyze the boring samples for explosives, TCL metals, TCL volatiles, and TCL semivolatiles.

Phase III

- If the soil boring samples are significantly contaminated, collect sediment samples from Green Pond Brook and Picatinny Lake near the contaminated borings. If the Bldg. 732 boring is contaminated, collect surface and bottom water samples from Green Pond Brook.
- Analyze the surface water and sediment samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

5.2.9.22 Site 109 — Building 445, Pyrotechnic Plant

Phase I

- Inspect the area around the building for signs of visible contamination, drains, and the reported sump behind the building.
- Collect one surface soil sample from each area of stained soil to a depth of 0.3 m (1 ft) and collect one surface soil sample from each side of the building to a depth of 0.6 m (2 ft).

- Collect one sediment sample to a depth of 0.6 m (2 ft) from each drain receiving effluents from the building and from the sump.

- Collect one drive point water sample over a 1.5-m (5-ft) interval from the water table at each of three different areas (a total of three samples) potentially downgradient from the building.

- Analyze all samples for TCL metals, nitrates, propellants, and explosives.

Phase II

- Drill one soil boring in the center of each significantly contaminated area identified by the Phase I analyses. Collect soil samples and analyze them for the contaminants found in the surface soil samples.

- Install two monitoring wells downgradient from the Site to monitor the the levels of TCL metals, nitrates, propellants, and explosives.

Phase III

Determine the need for additional soil and water sampling based on the Phase II results.

5.2.9.23 Site 110 — 500 Area

- Inspect the narrow-gauge railroad bed to locate propellant sticks.

- Remove any propellant found during the inspection.

5.2.9.24 Site 113 — Building 561

Phase I

- Visually inspect the former location of Bldg. 561 (which was destroyed under TECUP) for signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the building location and from the center of each visibly contaminated area.

- Drill one soil boring each on the east and west sides of the former building location and collect at least two samples from each boring.

- Analyze all soil samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

Drill additional soil borings if warranted by the results of the Phase I analyses.

5.2.9.25 Site 137 - Building 382

Phase I

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Conduct a geophysical survey around the building to locate the disposal pit.

- If the pit is found, collect three hand-auger samples from a depth of 0.8 m (2.5 ft). If the pit is paved over, drill through the pavement to obtain samples.

- Collect one surface soil sample from each area of stained soil.

- Analyze all samples for all TCL parameters except dioxin and for explosives.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the significant contaminants identified by the Phase I analyses.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.9.26 Site 147 — Building 520

Before Phase I activities begin, determine the exact location of former Bldg. 520 (the building was destroyed under TECUP) and the route of the guncotton line (Site 16) through the area.

Phase I

- Visually inspect the building location for signs of contamination and to locate the reported disposal pits. Use old detail maps and geophysical methods as necessary to locate the pits.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building and from the center of each visibly contaminated area, within 6 m (20 ft) of the building location.

- If the disposal pits are found, drill one soil boring in the center of each pit, and drill one soil boring within 9 m (30 ft) of the former building's north side. Collect samples from the top, pit bottom depth, and the bottom of each boring.

- Analyze all soil samples for propellants, TCL semivolatiles, and TCL metals. Analyze the soil boring samples for TCL volatiles.

Phase II

Drill additional soil borings if warranted by the results of the Phase I analyses.

5.2.9.27 Site 148 — Building 527

Closure Plan

Revised RCRA closure plans for Bldg. 527 include collecting 24 chip samples and 2 condensate grab samples and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Visually inspect the area around the building to locate signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each area of visible contamination.

- Analyze the samples for explosives, TCL volatiles, and TCL semivolatiles.

Phase II

Drill soil borings if contamination is found. The number and locations depend on the contamination found in the Phase I program.

5.2.9.28 Site 149 — Building 541

Phase I

- Visually inspect the area around the former building for signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building and from the center of each visibly contaminated area.

- Drill one soil boring at a location downslope from the building's former location. Collect samples from the boring.

- Analyze the surface soil and boring samples for explosives and TCL semivolatiles. Also, analyze the soil boring samples for TCL volatiles.

Phase II

Drill additional soil borings if warranted by the results of the Phase I sampling.

5.2.9.29 Site 150 — Building 555

Phase I

- Visually inspect the area around Bldg. 555 to locate signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) within 16 m (50 ft) of each side of the building at the center of each area of contamination located by the inspection.

- Drill one soil boring at the center of the west side and no farther than 9 m (30 ft) from the building and collect samples.

- If possible, collect samples from the drainpipes in Bldg. 555. Choose sampling locations by inspection of building interior. Because material may be unstable, take caution to ensure safety of workers collecting samples.

- Analyze the samples for propellants and explosives.

Phase II

Collect additional surface samples and/or drill soil borings if warranted by the results of the Phase I sampling program.

5.2.9.30 Site 156 — Buildings 813, 816, and 816B

Phase I

- Visually inspect the area around the buildings for signs of soil contamination.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.

- Drill two soil borings, one between Bldg. 813 and Picatinny Lake and another between Bldg. 816B and the lake. Collect samples from each boring.

- Collect sediment samples to a depth of 0.3 m (1 ft) from four locations along the lakeshore near Bldgs. 813 and 816.

- Analyze all samples for propellants, explosives, and TCL metals.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring in the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for propellants, explosives, and TCL metals.

5.2.9.31 Site 157 — Buildings 820 and 823

Phase I

- Collect surface samples to a depth of 0.3 m (1 ft) at four locations (two for each building) between Bldgs. 820 and 823 and Picatinny Lake.
- Drill two soil borings, one near each building. Collect samples from each boring.
- Analyze all soil samples for propellants, explosives, and TCL metals.

Phase II

- If the Phase I samples are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near each contaminated area.
- Analyze the sediment samples for TCL metals, propellants, and explosives.

5.2.9.32 Site 158 — Building 926

Phase I

- Collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near Bldg. 926.
- Analyze the samples for propellants and explosives.

Phase II

- If the sediment samples are significantly contaminated, collect additional sediment samples from other locations.
- Analyze the samples for propellants and explosives.

5.2.9.33 Site 159 — Building 975

Phase I

- Conduct a geophysical survey behind Bldg. 975 to locate disturbed soil or buried metal.

- If disturbed soil or buried metal is located, drill two soil borings in each area identified by the survey. Collect samples from the top, depths of the bottoms of disturbed areas or buried metal, and bottom of the borings.

- Analyze the boring samples for lead.

Phase II

- If the soil boring samples have significant lead contamination, collect two sediment samples to a depth of 0.3 m (1 ft) from Green Pond Brook near the contaminated borings. Collect surface and bottom water samples from the same locations.

- Analyze the samples for lead.

5.2.9.34 Site 178 — TECUP Buildings

Four TECUP building locations have been chosen for RI sampling: (1) Bldg. 557, a propellant plant, (2) Bldg. 565, a propellant plant, (3) Bldg. 323A, a high-explosive magazine, and (4) Bldg. 1052, a lead azide plant. The buildings are representative of those washed or burned under TECUP.

Phase I

- Inspect each of the four building locations for signs of visible contamination or soil staining.

- Collect one surface sample to a depth of 0.3 m (1 ft) at the center of each visibly contaminated area.

- Collect one surface soil sample at the center of each side of each building location perimeter; collect the samples just outside of the perimeters (16 samples altogether).

- Analyze the samples as follows:
  - For Bldgs. 557 and 565, analyze the for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.
  - For Bldg. 323A, analyze the samples for explosives, TCL volatiles, and TCL semivolatiles.
  - For Bldg. 1052, analyze the samples for lead, TCL volatiles, and TCL semivolatiles.
- Locate any remaining drain lines at each of the four building locations. If feasible, collect two samples from different locations in each located drain line.
- Analyze the drain line samples for explosives.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area at each building location. Collect samples from each boring.
- If the drain line samples are significantly contaminated, use geophysical methods to trace the route of each contaminated line. If feasible, collect additional samples from the traced lines.
- Analyze the soil and drain-line samples for the same parameters as in the Phase I samples.
- Consider removing any contaminated drain lines.

Phase III

- If the soil boring samples are significantly contaminated, install monitoring wells. Determine the number and location of the wells based on the soil boring results.
- If any one of the four building locations is found to be significantly contaminated, repeat the sampling program at other TECUP building locations. PTA and USATHAMA personnel should select these other locations.

5.2.9.35 Site 184 — Building 523

Closure Plan

The revised RCRA closure plan for Bldg. 523 includes sealing off and steam cleaning the building. Two wash water or condensate grab samples and four chip samples will be collected and analyzed for priority pollutant metals. The underground tanks will be sampled, flushed with water, and excavated. Two rinsate grab samples will be collected from each tank, and eight soil samples will be collected around the two tanks (the number of samples depends on the number of tanks). The water samples will be analyzed for priority pollutant metals and the soil samples will be analyzed for priority pollutant metals, VOCs, TPH, and, if necessary, EP toxicity for metals.

Proposed RI Plan

Phase I

- Inspect the area around the building for signs of visible contamination.
- In addition to sample collection in the closure sampling plan, collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each area of visible contamination.
- Analyze the samples for explosives, PCBs, TCL volatiles, TCL semi-volatiles, and TCL metals.

Phase II

- If significant contamination is found, drill one soil boring in the center of each contaminated area. Collect samples from each boring.
- Analyze the samples for the contaminants found in the Phase I samples.

5.2.10 Area J: Around Snakehill Road

5.2.10.1 Site 1 — G2 Area, Reaction Motors/Rocket Fuel Test Area (G-2 Road)

Phase I

- Conduct a complete field inspection of the Site; begin with a walkover of the Site, and use geophysical methods and aerial photos (Sitton 1989) as appropriate. Record the sizes and locations of building ruins, pads, and areas of soil staining.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums or containers located in the inspection.

- Conduct a geophysical survey in an area about 190 by 61 m (620 by 200 ft) along the south-southeastern edge of the Site, in the area of reported dumping. Use aerial photos as a location aid.

- Collect six or more surface soil samples to a depth of 0.3 m (1 ft) at locations around former and existing structures and pads, in formerly bermed areas, and in areas of stained soil.

- Collect two surface soil or sediment samples 100 m (330 ft) apart from the bed of each channel or depression that carries surface runoff. Collect two surface water samples at the same locations used for soil or sediment collection in each channel or depression that contains water.

- Analyze all soil, sediment, and water samples for explosives, TCL volatiles, TCL semivolatiles, lead, chromium, and phthalates.

Phase II

- If the dump area or large buried metal objects are located by the Phase I surveys, drill at least five soil borings at locations indicated by the surveys. Collect three to five samples from each boring: sample at least two different depths in the dumped material and at least one depth below it.

- Analyze each subsurface soil (boring) sample for explosives, lead, chromium, phthalates, TCL volatiles, and TCL semivolatiles. Select the three samples with the highest level of contamination and analyze for TCL metals.

- Determine the need for additional surface soil samples and soil borings based on results of surface and subsurface soil sampling programs.

- Install two monitoring wells downgradient from dump area and along the 250-m (825-ft) elevation contour. Exact locations should be determined by the inspection, sampling, and survey results. Screen the wells to intercept the water table. At least two weeks after well installation, collect samples for two successive quarters from the two new wells and Cove well.

- Analyze the groundwater samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrate, nitrite, cyanide, and macroparameters. Continue the groundwater monitoring program for wells with significant contamination.

5.2.10.2 Site 2 — G1 Area, Reaction Motors/Rocket Fuel Test Area (3500 Series Buildings)

Closure Plans

Revised RCRA closure plans for the concrete pad behind Bldg. 3517 include the following: collect six soil samples to a depth of 0.15 m (6 in.) around the perimeter of the pad northwest of Bldg. 3517, and analyze them for priority pollutant metals, base-neutral extractables, TPH, volatiles, PCBs, and EP toxicity for metals. Collect two chip samples from the pad and two condensate samples, and analyze them for priority pollutant metals and PCBs.

Proposed RI Plan

Phase I

- Carry out a thorough walkover and field inspection using geophysical and other methods to search for UXO, hazardous metal debris, and underground storage tanks, including those in the area of the former tank farm.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums and containers located.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the tanks for integrity. Remove the contents of unsound tanks and tanks that will not be used, and close

them in accordance with all applicable state and federal regulations.

- Collect 12 surface soil samples to a depth of 0.3 m (1 ft) from the following locations: two samples from each of the two possibly stained areas shown in aerial photos (Sitton 1989); one sample behind each of Bldgs. 3502, 3507, 3526, and 3540; two samples from outfall(s) of (former) flumes behind the test stands; and samples from two locations in the ditch carrying runoff around Bldg. 3521.

- Analyze the surface soil samples for explosives, TCL metals, TCL semivolatiles, herbicides, cyanide, fluoride, and nitrate.

- Collect surface water and sediment samples from two locations in the pond, and collect sediment samples from three locations in the reservoir and one location in each of the two streams on the Site.

- Analyze the sediment and surface water samples for TCL metals, TCL semivolatiles, explosives, herbicides, cyanide, nitrate, fluoride, gross alpha, and gross beta.

- Drill three soil borings, one in the sump area near Bldg. 3521 and one in each of the spill areas near Bldgs. 3513 and 3541. Collect split-spoon samples from the top, middle, and bottom of each boring (three samples per boring).

- Analyze the subsurface soil samples from borings near Bldgs. 3513 and 3541 for TCL volatiles and TCL semivolatiles. Analyze samples from the sump boring for TCL metals, TCL volatiles, TCL semivolatiles, nitrate, and fluoride.

- Install one monitoring well near Bldg. 3521. Position the screen to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples and water levels from the new well and from wells L, M, and N on the same day for two successive quarters.

- Analyze the groundwater samples for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, PCBs, explosives, fluoride, nitrate, nitrite, cyanide, macroparameters, gross alpha, and gross beta.

Phase II

- If elevated levels of gross alpha or gross beta are found in the surface water, sediment, or groundwater samples, collect additional

samples and analyze them to identify the specific radionuclides responsible for the activity.

- Collect additional surface and subsurface soil samples if warranted by the results of the Phase I surface soil sampling program.

- Collect additional surface water and sediment samples if warranted by the results of the Phase I sediment and surface water sampling program.

- Install additional monitoring wells if warranted by the results of the Phase I groundwater monitoring program.

5.2.10.3 Site 4 — 3600 Series Buildings, Reaction Motors/Rocket Fuel Test Area

Phase I

- Conduct a thorough walkover and field inspection using geophysical methods, if necessary, to search for UXO, underground storage tanks, and other metal objects. Search the western edge of the Site where propellant containers were reportedly buried.

- Remove UXO found by the search. Sample and remove buried drums and containers.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the tanks for integrity. Remove the contents of all unsound tanks or unused tank and close them in accordance with all applicable state and federal regulations.

- Collect six surface soil samples to a depth of 0.3 m (1 ft) from the following locations:

  - One sample from each of two locations near the PCB transformers in Bldg. 3602. Analyze the samples for PCBs.

  - One sample behind each of Bldgs. 3603, 3604, 3606, and 3607. Analyze the four samples for TCL metals, explosives, propellants, TCL semivolatiles, fluoride, nitrate, and aniline.

- Collect two sediment core samples to the lesser of a depth of 0.6 m (2 ft) or the basin bottom from two locations in the catch basin reported to collect runoff from Bldgs. 3601 and 3607. Collect one sample of water if it is present in the basin.

- Analyze the catch basin samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, explosives, propellants, PCBs, nitrate, nitrite, fluoride, gross alpha, and gross beta.

- Collect sediment samples to a depth of 0.15 m (6 in.) from two locations in the depression with the pond north of Bldg. 3618.

- Drill two soil borings, one at the depression outlet north of Bldg. 3618 and one near well M. Collect samples over 0.6-m (2-ft) intervals from the top, middle, and bottom of each boring (three samples per boring).

- Analyze the pond sediment and boring samples for explosives, propellants, TCL metals, TCL volatiles, TCL semivolatiles, fluoride, nitrate, nitrite, gross alpha, and gross beta.

- Install two monitoring wells, one near Bldg. 3618 and one between Bldgs. 3611 and 3612. Position the screens to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples on the same days on which samples are collected from Site 2 wells.

- Analyze the groundwater samples for explosives, TCL metals, TCL volatiles, TCL semivolatiles, pesticides, PCBs, cyanide, fluoride, nitrate, nitrite, gross alpha, gross beta, and macroparameters.

Phase II

- Excavate, sample, and dispose of any buried containers found along the western edge of the Site. Drill soil borings at the locations of any containers that have leaked or are surrounded by stained soil. Collect samples at depths below the bottom of containers. Select analytes based on the results of the sampling of the contents.

- Drill additional soil borings if warranted by the results of the Phase I surface soil sampling, sediment sampling in the upper part of the Site, and sampling in the catch basin.

- If elevated alpha or beta activities are measured, analyze additional samples to identify the specific radionuclides responsible for the activity.

5.2.10.4 Site 175 — Building 3801, Helicopter Maintenance

Phase I

- Inspect the areas around the building for signs of contamination and the drain outfall in the swamp.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area of visibly contaminated soil.
- Collect two surface water samples and two sediment samples to a depth of 0.3 m (1 ft) from the swampy area receiving effluent from the Site.
- Inspect the drums stored outside the building for content labels and any leakage.
- Sample and remove any leaking drums. Also collect one soil sample near each leaking drum.
- Analyze the soil, surface water, and sediment samples for TCL volatiles and TCL semivolatiles.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

5.2.11 Area K: Navy Hill

5.2.11.1 Site 3 — 1500 Series Buildings, Reaction Motors/Rocket Fuel Test Area

Closure Plans

RCRA closure plans for Bldgs. 1515 and 1518 include the following: For Bldg. 1515, analyze wash water and a core sample from the hearth for EP toxic metals. Collect 10 wipe samples. For Bldg. 1518, analyze wash water for EP toxic metals, collect five wipe samples, and analyze one sediment sample from the drainpipe outfall for priority pollutant metals and fluoride.

Proposed RI Plan

Phase I

- Conduct a thorough field inspection for UXO, underground tanks, and hazardous metal debris. Use geophysical methods if appropriate. Pay special attention to forested and other uncleared areas.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums and containers.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the integrity of the tanks. Remove the contents of unsound tanks and tanks that will not be used, and close them in accordance with applicable state and federal regulations.

- Collect nine surface soil samples to a depth of 0.3 m (1 ft) from the following locations:

  - Two samples from the former stained area marked in the 1963 aerial photo and one sample from behind each of the test stands in Bldgs. 1505A, 1505B, 1505C, and 1505D. Analyze the six samples for TCL metals, TCL semivolatiles, explosives, herbicides, PCBs, cyanide, fluoride, nitrate, gross alpha, and gross beta.

  - One sample from waste storage pallet area outside Bldg. 1509. Analyze the sample for explosives, TCL metals, benzene, toluene, xylenes, fluoride, and nitrate. Carry out a GC scan for TCL volatiles and TCL semivolatiles.

  - Two samples by the north-northeast end of Bldg. 1518. Analyze the samples for TCL metals and benzene, toluene, and xylenes (BTX). Carry out GC scan for TCL volatiles and TCL semivolatiles.

  Determine exact locations by field inspection.

- Collect seven sediment and surface water samples from the following locations: two samples from the drainage channel in the eastern part of the Site, three samples from the reservoir, and 2 samples from locations SW/SD3-2 and SW/SD3-3.

- Analyze the surface water and sediment samples for explosives, TCL metals, herbicides, TCL volatiles, TCL semivolatiles, PCBs,

fluoride, cyanide, nitrate, gross alpha, and gross beta. In addition, analyze the water samples for macroparameters.

- Collect one water sample from location SW/SD3-4 and analyze for sulfates.

- Install two monitoring wells. Position the screens to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples from the new wells and well O on the same day for two successive quarters.

- Analyze the groundwater samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, PCBs, explosives, nitrate, cyanide, fluoride, gross alpha, gross beta, and macroparameters.

- Collect air samples behind Bldg. 1505 during dry periods in the summer and fall and following the testing of solid fuel engines. Analyze the samples for explosives, TCL metals, and TCL volatiles.

Phase II

- If elevated levels of gross alpha or gross beta are found in any sample, then resample the location to identify the specific radionuclides responsible for the activity.

- Collect additional surface soil, sediment, and surface water samples if warranted by results of the Phase I sampling program.

- Drill soil borings and install additional monitoring wells if warranted by the results of the Phase I surface water, groundwater, sediment, and surface soil sampling programs.

5.2.11.2 Site 48 — Buildings 3314 and 3315, 90-Day Waste Accumulation Areas

Closure Plan

The revised RCRA closure plan for Bldg. 3314 includes collecting two samples of the condensate and rinsate from steam cleaning and two chip samples from the cleaned floor and analyzing the four samples for priority pollutant metals.

The revised closure plan for Bldg. 3315 includes collecting a surface soil sample from the most stained area under the pallet storage area and analyzing it for priority pollutant metals, TPH, and EP toxicity for metals. A subsurface sample from the same location will be collected and analyzed for VOCs.

Proposed RI Plan

Phase I

- Collect surface soil samples to a depth of 0.3 m (1 ft) from the following locations: one sample under each drip pipe projecting through the building walls and one sample from each area of soil staining. This includes areas around the pallet storage but excludes the area under the pallet, which is included in the closure sampling plan.

- Analyze the soil samples for TCL volatiles, TCL semivolatiles, lead, and chromium.

Phase II

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the results of the Phase I surface soil sampling program.

5.2.11.3 Site 172 — Parking Area Across from Building 3325

Phase I

- Inspect the parking area and its perimeter for oil staining. Do nothing further if no stained areas are located.

- Collect two asphalt chips from each stained area on the parking area. Collect four surface soil samples to a depth of 0.3 m (1 ft) from each stained area near the parking area.

- Analyze all samples for PCBs.

Phase II

- If significant PCB concentrations are found, drill one soil boring at each contaminated area on or next to the paved area. Collect samples from each boring.

- Analyze the boring samples for PCBs.

Phase III

Install monitoring wells if warranted b·· Phase II results.

5.2.11.4 Site 173 — Building 3404

Closure Plan

The revised RCRA closure plan for Bldg. 3404 includes sealing off and steam cleaning the building. Two rinsate grab samples and seven chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area around the building for signs of contamination. Do nothing further if the surrounding area appears to be clean.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.
- Analyze the samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

5.2.11.5 Site 174 — Building 3420, Old Sewage Treatment Plant

Phase I

- Conduct a field inspection to determine the boundaries of the sludge holding beds.

- Collect two sludge samples from each holding bed (six samples altogether).

- Collect one drive-point water sample topographically downgradient of each of the sludge beds (three samples altogether).

- Analyze the sludge and water samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, cyanide, PCBs, gross alpha, and gross beta.

Phase II

- Collect additional sludge samples from the beds if contamination is indicated by the Phase I results.

- Analyze the sludge samples for TCLP leachability.

- Determine the need for additional sludge, soil, and/or water samples based on the Phase I results and TCLP analyses.

5.2.12 Area L: Explosives Manufacturing

5.2.12.1 Site 5 — Shell Burial Area near Building 3150

Phase I

- If it is technically feasible and not dangerous for the workers, conduct a geophysical survey to determine the areal extent of the buried munitions.

- Surface soil and water sampling are not needed because the munitions are buried at depth.

- Install two monitoring wells, one between the Site and Bldg. 3150 and one near the northeast end of the Site. Position the screens to intercept the water table and to sample groundwater at depths greater than 6 m (20 ft) below the surface. Beginning at least two weeks after well installation, collect water samples from the new wells and wells 3, DM5-1, and DM5-2 on the same day for two successive quarters.

- Analyze the groundwater samples for explosives, propellants, TCL volatiles, TCL semivolatiles, TCL metals, nitrate, fluoride, and macroparameters.

Phase II

Determine remedial actions and additional Site controls based on the results of the geophysical survey and groundwater monitoring program.

5.2.12.2 Site 6 — Shell Burial Area near Building 3100

Phase I

- Conduct aquifer slug tests for wells DM6-1, DM6-3, and MW-5; measure static water levels in all wells quarterly for one year; and assess the local groundwater flow regime.
- If the groundwater flows in the northwest direction, install a new water table well between the west boundary of the Site and Belt Road. Determine the exact location of this well based on the aquifer tests and groundwater level data.
- Monitor the new and existing wells for two quarters for VOCs, explosives, propellants, nitrate, nitrite, ammonia, and macroparameters.

Phase II

Review the monitoring program after one year, and revise it if warranted by the available monitoring data.

5.2.12.3 Site 17 — Northern Tetryl Pits

Phase I

- Monitor wells DM17-1, DM17-2, and DM17-3 should continue to be monitored for one year for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, sulfate, and macroparameters.
- Conduct aquifer slug tests for wells DM17-1 and DM17-3, measure static water levels in the three existing wells quarterly for one year, and assess the groundwater flow regime in the study area.

Phase II

- If the groundwater data show significant contamination one soil boring should be drilled at the center of each of the four pits. Soil samples should be collected over a 2-ft interval from the top, pit bottom, and bottom of each boring.

- Collect two surface soil samples to a depth of 0.3 m (1 ft) at a location downgradient from the pits.

- Analyze the soil samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, and sulfate.

- Determine the need for additional soil borings and monitoring wells based on the soil sampling results.

5.2.12.4 Site 18 — Southern Tetryl Pit

Phase I

- Identify the exact location of the tetryl pit by using electromagnetic and ground-penetrating radar methods. Drill one soil boring in the center of the located pit and collect soil samples over a 0.6-m (2-ft) depth interval from the top, pit bottom, and bottom of the borehole.

- Analyze the boring soil samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, and sulfate.

- Conduct geophysical and soil gas surveys in the open area between Bldgs. 1029 and 1038 to locate the waste disposal area and contaminated area.

Phase II

- If the geophysical or soil gas survey results indicate significant contamination, collect surface and subsurface soil samples from the waste disposal area.

- Analyze the soil samples for contaminants found in the Phase I surveys and analyses.

Phase III

Implement surface water sampling and groundwater monitoring programs for the area if soil contamination is confirmed.

5.2.12.5 Site 35 — Buildings 1361A, 1363A, 1364, and 1365, Nitroglycerin Processing

Closure Plan

Revised RCRA closure plans for the spent acid tanks in Bldg. 1365 include sampling the air and liquids in each tank; analyzing the samples for nitrate and VOCs; and washing, steam cleaning, and removing the tanks. Two air samples, two liquid grab samples from each tank, and two steam condensate samples from each tank will be collected and analyzed for nitrates, VOCs (liquid samples only), and priority pollutant metals. The steam condensate samples will also be analyzed for pH.

Proposed RI Plan

Phase I

- Inspect the Site, especially the areas beneath the tanks, for visible contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each area of visible contamination.
- Sample the contents of the two tanks near Bldg. 1363A; then decontaminate, remove, and dispose of them (follow the same procedure as that for the tanks in Bidg. 1365).
- Collect one surface water sample and one sediment sample each from the catch basin outside Bldg. 1361A and from the stagnant water pool near Bldg 1364.
- Conduct a geophysical survey to locate the underground pipe and potentially contaminated areas.
- Analyze the sediment and water samples for nitrates, sulfates, explosives, and TCL metals.

Phase II

- If soil sampling confirms contamination, collect additional samples.
- Determine the need for surface and groundwater monitoring.

5.2.12.6 Site 36 — Building 3100, Hazardous Waste Storage

Phase I

- Inspect the area around the building, including the loading platform and the parking area, for signs of visible contamination. Note the locations of any drainage ditches and drain-pipe outfalls.
- Collect four surface soil samples to a depth of 0.15 m (6 in.) near the platform (two samples) and from the parking area (two samples). Additional samples should be collected from areas with signs of contamination and from any located ditches and drain-pipe outfalls.
- Analyze all the samples for explosives, propellants, TCL volatiles, TCL semivolatiles, TCL metals, cyanide, and nitrates.

Phase II

- Drill soil borings and collect composite surface and subsurface soil samples to delineate the extent of contamination if the surface soil samples are found to be contaminated.
- Install groundwater monitoring wells if warranted by the soil sampling results. Take the locations of the Site 6 wells into consideration if wells are installed for Site 36.

5.2.12.7 Site 41 — Building 1094, Lab-Pack Repacking Facility

Phase I

- Inspect the area around the building, including the parking area, for visible contamination. Locate any drain-pipe outfalls and ditches.
- Collect four surface soil samples to a depth of 0.15 m (6 in.) from the loading area (two samples) and the parking area (two samples).

Collect one soil sample from each area with signs of contamination and from each drain outfall and ditch.

- Analyze the soil samples for TCL metals, herbicides, pesticides, TCL volatiles, PCBs, TCL semivolatiles, and TCLP leachability (if necessary).

Phase II

- Install soil borings and collect additional surface and subsurface soil samples to delineate the extent of contamination if warranted by the Phase I analyses.

- Install groundwater monitoring wells if warranted by the soil sampling results. Take the locations of the Site 17 wells into consideration if wells are installed for Site 41.

5.2.12.8 Site 42 — Building 3114, PCB Storage Facility

Phase I

- Inspect the area around the building, drain outfalls, and nearby parking area for visible contamination.

- Collect two surface soil samples to a depth of 0.15 m (6 in.) from the south side of the parking area. Core into the paved parking area at four locations to collect four soil samples beneath it. Collect one additional sample from any located drainage ditches or pipe outfalls or from any discolored areas.

- Analyze the soil samples for all TCL parameters, uranium, explosives, propellants, and TCLP leachability (if necessary).

Phase II

- Drill soil borings and collect additional surface and subsurface soil samples to delineate the extent of contamination if warranted by the Phase I analyses.

- Collect surface water samples and monitor groundwater if warranted by the soil sample analyses.

5.2.12.9 Site 43 — Building 3157, Pesticides Storage Area

Closure Plan

Revised RCRA closure plans for Bldg. 3157 include collecting two samples from the waste storage tank and analyzing them for pesticides, herbicides, and VOCs. Two grab samples of condensate from steam cleaning the building will be analyzed for priority pollutant metals. Two chip samples from the cleaned building floor will also be analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Collect chip samples from the center of each of the two pads located outside Bldg. 3157.
- Analyze the chip samples for pesticides, herbicides, and TCL metals.
- Collect three soil samples to a depth of 0.15 m (6 in.) at 15-m (50-ft) intervals along the drainage ditch, starting near the pads. Determine exact locations by field inspection.
- Analyze the soil samples for TCL metals, pesticides, herbicides, Mirex, and cyanide.
- Collect two water samples from the ditch during the spring and summer (four samples altogether), when there is water in the ditch. Collect one sample near the pad and the other 100 m (330 ft) downstream.
- Analyze the surface water samples for TCL metals, pesticides, herbicides, Mirex, fluoride, and cyanide.

Phase II

- Collect additional soil or water samples from the ditch if warranted by the results of the Phase I sampling. If contamination in the ditch is found to be high, drill soil borings.
- Clean the pads if significant contamination is found in the chip samples from the pads. Collect chip samples after the cleaning and analyze them for contaminants found prior to the cleaning.

5.2.12.10 Site 51 — Hazardous Material Storage Tanks near Building 1380

Closure Plan

The revised RCRA closure plan includes collection of one air bomb sample and one liquid sample from each of the two tanks for the analyses of nitrates and VOC (liquid samples only). Each tank will be washed, steamed out, and removed. Two steam condensate grab samples from each tank will be analyzed for priority pollutant metals, nitrates, and pH. If discolored areas are uncovered under the foundation of any tank, soil samples will be collected and analyzed for VOCs, nitrate, and EP toxicity for metals. If an area is found to be contaminated, additional sampling will be done.

Proposed RI Plan

No additional sampling activities are proposed at this time. Should clean closure not be possible, the closure plan should be revised once new data become available.

5.2.12.11 Site 77 — Building 3150

Closure Plan

The revised RCRA closure plan for the machine shop waste storage area includes collecting two condensate grab samples and three chip samples and analyzing them for priority pollutant metals.

The revised closure plan for the underground storage tanks includes removal of the tanks and collection of 15 soil samples around each tank; the samples will be analyzed for VOCs, TPH, priority pollutant metals, and possibly EP toxicity for metals. Two wash water or condensate samples will be collected for each tank and analyzed for priority pollutant metals.

The revised closure plan for the basement waste oil storage room includes collecting two rinsate grab samples and two chip samples and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the exterior perimeter of Bldg. 3150, especially near the machine shop and basement waste storage entrances.

- If stained or spill areas are noted, collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.

- Analyze the samples for TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

- If significant contamination is found in the surface soil samples, drill one soil boring near each area of contamination and collect samples from each boring.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and TCL metals.

Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

5.2.12.12 Site 91 — Building 1301

Closure Plan

The revised RCRA closure plan for Bldg. 1301 includes steam cleaning and washing the walkway outside and behind Room E-7. Two rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area behind Bldg. 1301 to locate the reported lead azide washout area. Use geophysical methods if necessary.

- Collect five surface soil samples to a depth of 0.3 m (1 ft), two from separate locations along the waste storage walkway and three from separate locations in the washout area (if it is located).

- Analyze all samples for explosives, propellants, and lead.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring in the center of each contaminated area. Collect at least two samples from each boring over 0.6-m (2-ft) intervals.

- Analyze the boring samples for explosives, propellants, and lead.

Phase III

Determine the need for monitoring wells based on the results of the Phase II soil boring program.

5.2.12.1. .03 — Reservoir near Building 3159

Phase I

- Survey the reservoir for UXO. Use geophysical techniques, underwater television cameras, and other methods (e.g., those available to EOD teams) as necessary.

- Remove or mark (with buoys) any UXO located during the survey.

Phase II

- If UXO are found, collect two surface water samples, two bottom water samples, and two sediment samples near each item.

- Analyze the samples for explosives and lead.

5.2.12.14 Site 114 — Building 1033

Phase I

- Visually inspect the area around Bldg. 1033 for signs of contamination.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each visibly stained area around the building.

- Collect four sediment samples from Robinson Run at intervals of 30 m (100 ft) along its shore. Sampling should begin at the

discharge point from Bldg. 1033 and should continue 300 ft downstream from the building.

- Analyze all samples for explosives.

Phase II

Collect additional surface soil and sediment samples and drill soil borings if warranted by the results of the Phase I analyses.

5.2.12.15 Site 160 — Building 1029

Phase I

- Visually inspect the area around Bldg. 1029 for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated area.
- Analyze all samples for explosives, propellants, and tetrahydrofuran.

Phase II

Collect additional surface soil samples and/or drill soil borings if the surface soil samples show contamination.

5.2.12.16 Site 161 — Building 1031

Closure Plan

Revised RCRA closure plans call for steam or hot-water cleaning of the building and equipment. Two wash water or condensate grab samples and 27 chip samples will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Visually inspect the area around Bldg. 1031 for signs of contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the building and from the center of each area of visible contamination.
- Collect surface water and sediment samples from two locations in the swamp behind the building.
- If areas of contamination are identified during the visual inspection, drill one soil boring 16 m (50 ft) downslope from the building toward Robinson Run. Collect samples from the boring.
- Analyze all water, sediment, and soil boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

Drill additional soil borings; collect additional surface soil, sediment, and surface water samples; and/or install monitoring weils if warranted by the results of the Phase I investigations.

5.2.12.17 Site 162 — Buildings 1070, 1071, and 1071C

Before Phase I activities begin, determine exact location of Bldg. 1070.

Phase I

- Visually inspect the areas around Bldgs. 1070, 1071, and 1071C for signs of contamination. Conduct a geophysical survey near Bldg. 1071 to search for a reported explosives wastewater leach field.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of Bldg. 1071 and from the center of each area of visible contamination.

- If the leach field lines are located, drill two soil borings next to each line and to a depth of 0.9-1.5 m (3-5 ft) below the line. Collect samples from each boring.

- Analyze all soil samples for explosives, TCL volatiles, and TCL semivolatiles.

Phase II

- If contamination is found in the surface soil samples, drill one soil boring in the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for the contaminants found in the Phase I samples.

5.2.12.18 Site 166 — Buildings 1354, 1357, and 1359

Phase I

- Visually inspect the areas around Bldgs. 1354, 1357, and 1359 for signs of contamination.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each area of soil contamination.

- Analyze all samples for explosives.

Phase II

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

5.2.12.19 Site 167 — Buildings 1373 and 1374

Phase I

- Visually inspect the areas around Bldgs. 1373 and 1374 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection. Use detailed maps and geophysical methods as necessary.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.

- Collect one water and one sediment sample from each sump in Bldg. 1373.

- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.

- Analyze all samples for explosives.

Phase II

Determine the need for additional sampling based on the results of the Phase I sampling.

5.2.12.20 Site 168 — Buildings 1400, 1402, and 1403

Phase I

- Visually inspect the areas around Bldgs. 1400, 1402, and 1403 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection; use detailed maps and geophysical methods as necessary.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.

- Collect one water and one sediment sample from the sump in Bldg. 1400 and from each of the two sumps in Bldg. 1403.

- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.

- Analyze all soil samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

Determine the need for additional sampling based on the results of the Phase I sampling.

5.2.12.21 Site 169 — Buildings 1408, 1408A-C, 1409, and 1411

Phase I

- Visually inspect the areas around Bldgs. 1408, 1408A-C, 1409, and 1411 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection; use detailed maps and geophysical methods as necessary.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.
- Collect one water and one sediment sample from each sump or catch basin in each building.
- Collect one sediment sample to a depth of 0.3 m (1 ft) from two locations in the swamp between Bldgs. 1408A and 1408B.
- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.
- Analyze all samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

- Collect additional soil and sediment samples if warranted by the results of the Phase I sampling.
- Drill soil borings and collect surface water samples from the swamp if warranted.

5.2.12.22 Site 170 — Buildings 1462-1464

Phase I

- Visually inspect the area around Bldgs. 1462-1464 for signs of contamination. Search PTA records and, if necessary, interview additional personnel to determine where wastewater discharges (if any) occurred.

- Collect two surface soil samples to a depth of 0.3 m (1 ft) near each of the four sump tanks. Choose sampling locations under valve or pipe inlets or outlets.

- Collect one sample to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.

- Analyze all samples for explosives, TCL volatiles, and TCL semivolatiles.

Phase II

- If significant contamination is found, drill soil borings to determine its depth.

- Collect additional surface soil samples if warranted.

5.2.12.23 Site 171 — Buildings 3106, 3109, and 3111

Phase I

- Inspect the areas around the buildings for signs of contamination. Do nothing further if the areas are clean.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.

- Analyze the samples for TCL volatiles, TCL semivolatiles, and lead.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and TCL metals.

Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

5.2.12.24 Site 176 — Little-League Baseball Field

Phase I

- Conduct a geophysical survey to locate the pits and areas reportedly covered with the dredge material.

- Drill one soil boring in each area of electromagnetic anomalies and collect soil samples from the top, depth of the bottom of each anomaly, and bottom of each boring.

- Analyze the samples for cyanide, TCL volatiles, TCL semivolatiles, TCL metals, PCBs, propellants, explosives, pesticides, and herbicides.

Phase II

- If the Phase I samples contain significant contaminant concentrations, collect additional soil samples for the parameters found in the Phase I analyses.

- Determine the need for monitoring wells based on the Phase I results.

5.2.12.25 Site 177 — Sanitary Sewer System Breaks/Leaks

Phase I

- Locate and study the reports of Havens and Emerson Inc. and Visu-Sewer to identify sewer system breaks outside of Subbasins 6 and 7. If the reports cannot be used to identify breaks, survey the PTA sewer system (e.g., with a television camera) to locate breaks and faults (omit Subbasins 6 and 7 from the survey).

- Sample four locations of crushed or cracked pipes in Subbasins 6 and 7 and two locations outside the two subbasins and downstream from important contamination sources. Collect the samples by drilling two soil borings to a depth of 0.6 m (2 ft) below the pipe bottom; drill one boring on each side of the sewer pipe. Collect two samples from each of the 12 borings, one from the depth of the break or fault and the other from the bottom. The six locations are:

  - Between manholes (MHs) 350 and 352 downstream from Site 6 and Bldg. 3100.

- At MH 324 downstream from Bldgs. 3022 and 3028.
- At MH 465 in a region of crushed and cracked pipe.
- At MH 455 in a region of crushed and cracked pipe.
- Near MH 4A downstream from Bldg. 95.
- Near MH 25, downstream from Bldg. 24.

- Analyze the boring samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

- Classify as major or minor all sewer system faults or breaks located by the Phase I survey.
- Drill soil borings at all major faults or breaks and collect subsurface samples as described under Phase I.
- Analyze the samples as described under Phase I.

Phase III

Determine additional locations for drilling soil borings and collecting samples based on the results of the Phase I and II programs.

5.2.13 Area M: 600 Buildings Area

5.2.13.1 Site 15 — Buildings 616 and 654, Munitions Test Area

Static Detonation Area

Phase I

- Collect five soil samples from the pad beneath the test stand and the surrounding area. Sample at a depth of 0-0.15 m (0-6 in.) at the corners and center of the area (which is 2.4 m [8 ft] square).
- Analyze the soil samples for TCL metals, explosives, propellants, and uranium.

- Collect soil samples from a depth of 0-0.15 m (0-6 in.) at the base of all on-Site drums, above ground tanks, and a cylinder reported to be partially buried. Analyze for TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

- Drill soil borings at locations determined by the results of the surface soil sampling program and analyze the boring samples for contaminants determined to be significant from the previous results.

- Groundwater monitoring wells should be installed and sampled if the soil boring samples show significant contamination.

Projectile Firing Area

Phase I

- Collect surface soil samples (the number of samples depends on the circumference of the sand pile) from locations no more than 0.9 m (3 ft) apart in a ring around each sand pile. Each sample should be collected over a depth interval of 0-0.15 m (0-6 in.).

- Collect sand samples from the piles according to Methods II-7 or II-8 (EPA 1987d).

- Analyze all samples for explosives, propellants, uranium, and TCL metals.

Phase II

- Drill soil borings at locations determined by the results of the surface soil and sand pile sampling programs. Collect split-spoon samples at 0.8-m (2.5-ft) intervals for the first 3 m (10 ft) and at 1.5-m (5-ft) intervals thereafter to refusal.

- Analyze the boring samples for contaminants determined to be significant from the previous results.

- Groundwater monitoring wells should be installed and sampled if the soil boring samples show significant contamination.

5.2.13.2 Site 115 — Building 611

Phase I

- Visually inspect the area around Bldg. 611 to locate signs of contamination.

- Collect one surface soil sample from a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building.

- Analyze the samples for explosives.

Phase II

Drill soil borings if warranted by the results of the Phase I analyses.

5.2.13.3 Site 152 — Buildings 604 and 604C

Closure Plan

Revised RCRA closure plans for the underground tanks at Bldg. 604C include excavating and cleaning the tanks. One of the cleaned tanks will be reburied for reuse, and the other will be flashed and scrapped. Two wash or condensate grab samples and four soil samples (three surface and one from beneath tank 2) will be collected and analyzed for priority pollutant metals and nitrates. The soil samples will also be analyzed for VOCs and, if necessary, EP toxicity for metals.

Proposed RI Plan

Phase I

- Visually inspect the area around the buildings for signs of contamination.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from each side of the storage area, each side of the catch basin, and from the center of each area of visible contamination (at least eight samples altogether).

- Drill two soil borings, one between the two tank locations and one next to the catch basin, to a depth of 1-1.5 m (3-5 ft) below the respective tank or catch basin bottoms. Samples should be

collected at the top, depth of the respective tank or catch basin bottoms, and bottom of the borings.

- Analyze all soil samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

Phase II

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the results of the Phase I sampling program.

5.2.13.4 Site 153 — Building 606

Phase I

- Visually inspect the area around Bldg. 606 for signs of contamination.
- Collect one surface soil to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.
- Analyze the samples for TCL volatiles, TCL semivolatiles, and TCL metals.
- No further action is required if the area is clean.

Phase II

Collect additional surface soil samples and/or drill soil borings if warranted by the results of the Phase I sampling.

5.2.13.5 Site 154 — Buildings 617 and 617G

Phase I

- Visually inspect the areas around Bldgs. 617 and 617G for signs of contamination.
- Collect one surface soil sample over a depth of 0.15 m (6 in.) from each side of Bldg. 617 and from the center of each visibly contaminated area.

- Analyze the soil samples for TCL volatiles, TCL semivolatiles, and explosives.

Phase II

Collect additional surface soil samples and/or drill soil borings around Bldg. 617 if warranted by the results of the Phase I sampling.

5.2.13.6 Site 155 — Buildings 620 and 620B

Phase I

- Visually inspect the areas around Bldgs. 620 and 620B for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.
- Analyze the soil samples for propellants, explosives, TCL volatiles, and TCL semivolatiles.

Phase II

Collect additional surface soil samples and/or drill soil borings if contamination is found in the surface soil samples.

5.2.14 Area N: Firing and Test Ranges

5.2.14.1 Site 7 — Building 1242, Munitions and Propellants Test Area

Phase I

- Conduct a surface reconnaissance of the common firing area and the two impact areas to locate any obvious signs of contamination.
- Conduct a geophysical survey to locate UXO, drums, and other buried objects.
- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect four surface soil samples from the firing area at 15-m (50-ft) intervals. Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Collect three surface water and sediment samples from Green Pond Brook in the 900-yd range area, one at the northern boundary of PTA, one at the middle of the Site, and one at the lower edge of the Site. Collect the water samples quarterly and review the results after one year.

- Analyze all soil, sediment, and water samples for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta. Analyze the water samples for macroparameters in addition.

Phase II

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

5.2.14.2 Site 8 — Building 1222, Munitions and Propellants Test Area

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect ten surface soil samples to a depth of 0.15-0.3 m (6-12 in.) on a grid of ten sampling points in the southeastern part of the Site. Drill one soil boring at four of the same sampling locations and collect three samples over 0.6-m (2-ft) intervals from each of the four borings.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Collect at least four soil samples from each spent sand pile near the bunker and the sand pile near the southeast corner of the Site. (An estimated total of 12 sandpile samples will be collected.)

- Analyze all soil samples for TCL metals, TCL volatiles, TCL semivolatiles, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

- Collect air samples at two downwind locations, one near the sand bunker and another near the sand pile. Collect samples in the dry periods in the summer and fall and analyze for explosives, TCL metals, and TCL volatiles.

Phase II

Collect subsurface and additional surface soil samples and/or install monitoring wells if warranted by the Phase I results.

5.2.14.3 Site 9 — Building 674, Munitions and Propellants Test Area

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect five surface soil samples to a depth of 0.15-0.3 m (6-12 in.):

  - Two samples south of Bldg. 673.

  - One sample about 30 m (100 ft) east of Dames & Moore sampling locations SS9-4 and -5.

  - One about 30 m (100 ft) north of sampling location SS9-1.

  - One about 30 m (100 ft) north of sampling location SS9-3.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Drill one soil boring at each of the five Dames & Moore surface soil sample locations where contamination was detected.
- Drill one soil boring at each of three additional locations at the edge and off the Site in the impact area of some munitions testing.
- Collect each boring sample over a 0.6-m (2-ft) interval at the top, middle, and bottom of each boring for a total of 24 samples.
- Collect three surface water and sediment samples from the unnamed stream crossing the Site. One sample should be collected where the stream enters the Site, another in the middle of the Site, and the third below its exit from the Site.
- Collect and analyze the surface water samples quarterly and review the results after one year.
- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta.

Phase II

Collect additional soil and water samples and/or install monitoring wells if warranted by Phase I results.

5.2.14.4 Site 10 — Chemical Burial Pit

Phase I

- Conduct a geophysical survey to locate the pit and UXO, drums, and other buried objects. Remove any UXO located during the survey, and sample and remove any located buried drums.
- If the pit can be located, drill one soil boring in the center of the pit and two others in the pit area about 2.4 m (8 ft) from both the northwest and southeast side of the pit. If the pit cannot be located, drill three soil borings in the suspected area of the pit. Collect split-spoon samples at 0.6-m (2-ft) intervals from the surface to 0.3 m (1 ft) below the depth of the pit bottom.
- Analyze all soil and water samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, herbicides, PCBs, explosives,

propellants, nitrate, nitrite, fluoride, cyanide, fluoroacetate, gross alpha, and gross beta.

- Resample the three existing monitoring wells for two successive quarters to determine if the quality of the groundwater has changed.

Phase II

If significant soil contamination is found, additional soil borings and monitoring wells may be needed to determine the extent of contamination.

5.2.14.5 Site 11 — Buildings 647, 649, and 650, Munitions Test Range

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located by the survey. Remove any located drums after sampling.

- Collect nine surface soil samples to a depth of 0.15-0.3 m (6-12 in.):

  - Four samples in the area between Bldg. 647 and Dames & Moore sampling locations SS11-3 and -4.

  - One sample north of the impact area and sampling locations SS11-3 and -4.

  - One sample each from the areas of Bldg. 649, Bldg. 650, and the burning cage (three altogether).

  - One sample half-way between Bldg. 650 and the burn cage.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Drill two soil borings, one adjacent to Dames & Moore sampling locations SS11-1 and -2 and the other adjacent to sampling location SS11-7. Collect soil samples over 0.6-m (2-ft) intervals from top,

middle, and bottom of each boring, starting at a depth of 0.6 m (2 ft).

- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

- Collect air samples at two locations, one downwind from the Bldg. 647 firing area and the other downwind from Bldg. 650 during dry periods in the summer and fall. Analyze the samples for explosives, propellants, TCL metals, and TCL volatiles.

Phase II

Collect additional surface and subsurface soil and air samples and/or install monitoring wells if warranted by Phase I results.

5.2.14.6 Site 12 — Building 656, Munitions Waste Pit

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate the pit (if it is not found during the reconnaissance) and any UXO, drums, and other buried objects.

- Excavate and remove any UXO and drums found during the survey. Remove the located drums after sampling.

- If the pit is located, drill one soil boring at each of at least three locations near the pit. Drill to a depth of 0.3 m (1 ft) below the pit bottom. Collect soil samples over 0.6-m (2-ft) intervals at the top, middle, and bottom of each hole, starting at a depth of 0.6 m (2 ft).

- Drill three additional soil borings, one near Dames & Moore sediment sampling location SD12-1, a second near Bldg. 656, and the third just east of soil sampling location SS12-1. Collect boring samples as described above.

- Analyze all soil samples for TCL metals, explosives, propellants, nitrate, nitrite, cyanide, gross alpha, and gross beta.

Phase II

- Collect additional surface and subsurface soil samples if warranted by the results of the Phase I sampling.
- Install monitoring wells in the area if significant contamination is found by the Phase I sampling.

5.2.14.7 Site 13 — Building 640, Munitions/Pryotechnics Test Area

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.
- Conduct a geophysical survey to locate UXO, drums, and other buried objects.
- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.
- Collect four surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.): two from the northwest side of the Site, one from the northeast side of the Site, and one between Bldg. 640 and the swamp. Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.
- Install one additional monitoring well in the area northwest of the swamp area where testing occurred to accurately determine if the groundwater beneath the Site has been affected by surface activities. Establish a monitoring program for this well. During drilling of the well, collect a soil sample over a 0.6-m (2-ft) interval at three depths: 0.6 m (2 ft) below the surface, the middle, and the bottom of the boring.
- Collect two surface water and sediment samples from the swamp.
- Analyze all samples for explosives, propellants, TCL metals, TCL semivolatiles, nitrate, and nitrite. Analyze all water samples for macroparameters in addition.

Phase II

- Collect additional surface soil, surface water, and sediment samples if warranted by the Phase I results.

- Drill soil borings and install additional monitoring wells if warranted by the Phase I results.

5.2.14.8 Site 14 — Building 636, Munitions Test Area

Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect five surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) in the area between the firing area and the bunker:

  - Three northwest of Dames & Moore sampling locations SS14-1 and

  - One half-way between Bldgs. 636 and 638.

  - One 15 m (50 ft) southeast of sampling location SS14-3.

- Collect three samples from each spent sand pile in the wetlands. A total of about nine samples will be needed. Also sample all disturbed areas.

- Drill one soil boring at each of the four Dames & Moore surface soil sampling locations where elevated contaminant levels were found. Collect each sample over a 0.6-m (2-ft) interval. The sampling depths are 0.6 m (2.0 ft) below the surface, the middle, and the bottom of each boring.

- Collect two surface water and two sediment samples from the pond.

- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta.

- Collect air samples at two locations: one downwind from the sand bunker (Bldg. 638) and the other downwind from the firing area during dry periods in the summer and fall. Analyze samples for explosives and propellants, TCL metals, and TCL volatiles.

Phase II

Collect additional surface soil, surface water, and air samples; drill additional soil borings; and/or install monitoring wells if warranted by Phase I results.

5.2.15 Area O: Lake Denmark

5.2.15.1 Site 54 — Lake Denmark

Phase I

- Make an effort to locate UXO and other metal debris on the lake bottom. Use techniques such as geophysical surveying and scanning with underwater television cameras.

- Remove or mark (with buoys) any dangerous items that are located.

- Collect 10 surface water and 10 lake-bottom sediment samples. Determine exact locations by field inspection and based on the search for UXO and metal debris on the lake bottom.

- Analyze all sediment and water samples for TCL volatiles, TCL semivolatiles, TCL metals, PCBs, pesticides, herbicides, explosives, nitrate, nitrite, gross alpha, gross beta, and macroparameters (water samples only).

- Collect surface water samples quarterly for one year and analyze for the same parameters. Review the monitoring program after one year.

Phase II

Determine the need for additional sediment and water sampling based on the results of Phase I sampling.

5.2.15.2 Site 164 — Building 1217

Phase I

- Inspect the area around the building for areas of soil disturbance or staining. Do nothing further if the area is clean.
- Collect one surface soil sample from the the center of each visibly contaminated area.
- Analyze the samples for propellants, explosives, nitrate, and nitrite.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for propellants, explosives, nitrate, and nitrite.

5.2.16 Area P: Miscellaneous Storage

5.2.16.1 Site 27 — Former Salt Storage Area

- Collect surface water samples quarterly from Green Pond Brook at a location about 6 m (20 ft) downstream from the Site.
- Collect groundwater samples for two quarters from monitoring well DM27-1.
- Analyze the surface water and groundwater samples for macroparameters and cyanide.

5.2.16.2 Site 78 — Building 91

Closure Plan

Revised RCRA closure plans for Bldg. 91 include collecting two chip samples from cleaned building surfaces and two grab samples of wash water or rinsate and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the Site and surrounding area for visible contamination.
- Collect one soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, and TCL metals, nitrate, and sulfate.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table, whichever comes first in each area of significant soil contamination. Collect samples from each boring.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

5.2.16.3 Site 94 — Buildings 1600, 1601, 1604, 1609, and 1610

Phase I

- Collect surface soil samples to a depth of 0.3 m (1 ft) from areas near each of Bldgs. 1600, 1601, 1604, and 1609. Collect samples near exits, along perimeters, and from any stained areas.
- If the dry well can be located, collect samples from it:
  - If the well is open, collect one sample from the well bottom.
  - If the well is filled up, drill one soil boring in its center and collect samples over 0.6-m (2-ft) intervals.
- Collect sediment samples to a depth of 0.3 m (1 ft) from two locations in the lagoon at the north end of Bldg. 1604.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, TCL metals, gross alpha, and gross beta.

Phase II

- If the Phase I soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area and collect samples from each boring.
- If the Phase I sediment samples are significantly contaminated, collect surface water and additional sediment samples from the lagoon.
- Analyze all samples for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

Phase III

Install monitoring wells if the dry well or soil boring samples are significantly contaminated.

5.2.16.4 Site 119 — Buildings 46, 47, and 48, Propellant Storage

Phase I

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area around the buildings and collect one surface soil sample (to the same depth) at the entrance of each building.
- Analyze the surface soil samples for propellants.

Phase II

- If significant contamination is indicated by the Phase I analyses, drill one soil boring in the center of each contaminated area and collect samples for each boring.
- Analyze samples for contaminants found in Phase I samples.
- Determine the need for additional groundwater, soil, and surface-water samples based on the results.

5.2.16.5 Site 120 — Building 50, Propellant Storage

Phase I

- Inspect the area around Bldg. 50 to locate areas with visible contamination and the area in which propellant containers were reportedly opened.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area and collect one surface soil sample from the propellant opening area (if it is located).
- Collect one surface water sample and one sediment sample 0.3 m (1 ft) deep from the drainage ditch southeast of the building.
- Analyze all the samples for propellants.

Phase II

- Drill one soil boring in the center of each area of significant contamination identified by the Phase I analyses. Collect subsurface soil samples from each boring.
- Analyze the soil boring samples for the contaminants with elevated concentrations in the surface soil samples.
- Determine the need for additional surface water and groundwater samples based on the Phase I results.

5.2.16.6 Site 121 — Building 57, Chemical Storage

Phase I

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area and collect one surface soil sample at the building entrance.
- Collect one surface water and one sediment sample from the drainage ditch southeast of the building.
- Analyze the soil, sediment, and water samples for TCL volatiles, TCL semivolatiles, and TCL metals.

- Collect three surface soil samples to a depth of 0.15 m (6 in.) near the PCB transformer and mix them to make a composite sample for PCB analysis.

Phase II

- If contamination is found in the Phase I analyses, drill one soil boring in the center of each contaminated area and collect soil samples from each boring.
- Analyze the boring samples for the contaminants identified during Phase I.
- Determine the need for surface water samples to delineate the extent of contamination.

5.3 SAMPLING SUMMARY TABLES

Table 5.1 provides a matrix of types of RI activities proposed for each Site. Sampling prescribed by existing closure plans is not listed in the tables.

Sampling and testing needs are summarized in Tables 5.2-5.10 for the following areas:

- Table 5.2: surface soil and sediment
- Table 5.3: subsurface soil
- Table 5.4: surface water
- Table 5.5: groundwater
- Table 5.6: air
- Table 5.7: field inspections
- Table 5.8: geophysical surveys
- Table 5.9: drums and tanks
- Table 5.10: other.

To save space, many of the analytic categories in the tables are represented by numbers. Each table carries a footnote that provides a key for the numbers and corresponding category names.

TABLE 5.1 Summary of Proposed RI Activities for All Sites at Picatinny Arsenal[a]

Area and Site	Phase[b]	Activity[c]									
		FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
Area A											
34	See RI/FS plan and also GS and OT										
Area B											
20	I	-	-	-	-	X	-	-	-	-	-
24	I	-	-	-	-	-	X	X	-	X	-
Area C											
19	I	-	-	-	-	-	-	-	-	X	-
23	I	-	-	-	X	X	-	-	-	X	AT
25	I	-	-	-	-	-	-	-	X	X	AT,X
26	I	-	-	-	-	-	-	-	-	X	-
163	I	-	X	-	-	-	X	-	-	-	-
180	I	X	X	-	-	X	-	X	X	-	-
Area D											
21/37	I	-	-	-	-	-	-	-	-	X	X
29	I	-	-	-	-	-	X	-	-	X	X
39	I	-	-	-	-	-	-	-	-	-	TT
45	I	X	-	-	-	X	-	-	-	-	X
69	I	X	-	-	-	X	-	-	-	-	-
86	I	X	-	-	-	-	-	-	-	-	-
117	I	X	-	-	-	X	-	X	X	-	-
118	I	X	-	-	-	-	-	X	X	-	-
	II	-	-	-	-	-	-	-	-	X	-
122	I	X	-	-	-	X	-	X	X	-	-
123	I	X	-	-	-	X	-	X	X	-	-
182	I	X	-	-	-	X	-	-	-	-	-
183	I	X	-	-	-	X	-	-	-	-	-
Area E											
28	I	X	-	-	-	-	-	X	-	X	-
38	I	-	-	-	-	X	-	-	-	-	TT
44	I	-	-	-	-	X	-	-	-	-	TT,AS
	II	-	-	-	-	-	X	-	-	-	X

TABLE 5.1 (Cont'd)

Area and Site	Phase[b]	FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
		Activity[c]									
Area F											
60	I	X	-	-	-	X	-	-	-	-	-
61	I	X	-	-	-	X	-	X	-	-	-
104	I	X	X	-	-	X	X	X	X	-	-
106	I	X	-	-	-	X	-	-	-	-	-
111	I	X	-	-	-	X	-	X	-	-	X
124	I	X	-	-	-	X	-	-	-	-	-
125	I	X	-	-	-	X	-	-	-	-	-
126	I	X	-	-	-	X	-	-	-	-	-
138	I	X	-	-	-	X	-	X	-	X(DP)	-
139	I	X	X	-	-	X	X	X	-	-	-
140	I	-	-	-	-	X	-	-	-	-	-
141	I	X	-	-	-	X	-	X	-	-	-
142	I	X	-	-	-	X	-	X	-	-	-
143	I	X	-	-	-	X	-	X	-	-	-
144	I	X	-	-	-	X	-	X	-	-	X
145	I	X	-	-	-	X	-	X	-	-	-
146	I	-	-	-	-	X	-	X	-	-	X
Area G											
31	I	X	-	-	-	X	X	-	-	-	-
52/95	I	-	-	-	-	X	X	-	-	-	-
	II	-	-	-	-	-	-	-	-	X	-
96	I	X	-	-	-	X	-	-	-	-	-
101	I	X	X	-	-	X	-	-	-	-	-
134	I	X	X	-	-	X	-	-	-	-	-
135	I	X	-	-	-	X	-	-	-	-	-
136	I	X	-	-	-	X	-	-	-	-	-

TABLE 5.1 (Cont'd)

Area and Site	Phase[b]	Activity[c]									
		FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
Area H											
55	I	-	-	-	-	X	-	-	-	-	-
	II	-	-	-	-	-	-	-	X	-	-
62	I	X	-	-	-	X	-	X	X	-	-
64	I	X	-	-	-	X	-	X	X	-	-
98	I	X	-	-	-	X	-	-	-	-	-
100	I	X	-	-	-	X	-	X	X	-	-
127	I	X	-	-	-	X	-	-	-	-	-
128	I	X	-	-	-	X	-	-	-	-	-
129	I	X	-	-	-	-	-	-	-	-	X
130	I	X	-	-	-	X	-	-	-	-	-
131	I	X	-	-	-	X	-	-	-	-	-
132	I	X	-	-	-	X	-	-	-	-	-
151	I	X	-	-	-	X	-	-	-	-	-
Area I											
16	I	-	-	-	-	X	-	-	-	-	LT
30	I	-	-	-	-	X	-	-	-	-	-
32	I	-	-	-	-	X	-	-	-	-	-
33	I	-	-	-	-	X	-	-	-	-	-
40	I	-	-	-	-	X	-	X	-	-	-
47	I	X	-	-	-	X	-	-	-	-	-
50	I	X	-	-	-	X	-	X	-	-	-
53	I	-	-	X	-	X	-	X	X	-	X
	II	-	-	-	-	-	-	-	X	-	-
63/65	I	X	-	-	-	-	X	-	-	-	-
70	I	X	-	-	-	X	-	-	-	-	-
71	I	X	-	-	-	X	-	-	-	-	-
79	I	X	-	-	-	X	-	-	-	-	-
82	I	X	X	-	-	X	-	-	-	-	-
83	I	X	X	-	-	X	X	-	-	-	-
90	I	X	-	-	-	X	-	-	-	-	-
93	I	X	X	-	-	X	X	-	-	-	-
97	I	X	-	-	-	X	-	-	-	-	-
102	I	X	-	-	-	X	-	-	-	-	-
105	I	X	-	-	-	X	-	-	-	-	-

TABLE 5.1 (Cont'd)

Area and Site	Phase[b]	FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
		Activity[c]									
Area I (Cont'd)											
108	I	X	-	-	-	X	-	-	-	-	-
109	I	X	-	-	-	X	-	X	-	-	X
110	I	X	-	-	-	-	-	-	-	-	X
113	I	X	-	-	-	X	X	-	-	-	-
137	I	X	X	-	-	X	X	-	-	-	-
147	I	X	X	-	-	X	X	-	-	-	-
148	I	X	-	-	-	X	-	-	-	-	-
149	I	X	-	-	-	X	X	-	-	-	-
150	I	X	-	-	-	X	-	X	-	-	X
155	I	X	-	-	-	X	X	X	-	-	-
157	I	-	-	-	-	X	X	-	-	-	-
158	I	-	-	-	-	-	-	X	-	-	-
159	I	-	X	-	-	-	X	-	-	-	-
178	I	X	-	-	-	X	-	X	-	-	X
184	I	X	-	-	-	X	-	-	-	-	-
Area J											
1	I	X	X	X	X	X	-	-	-	-	-
	II	-	-	-	-	-	X	-	-	X	-
2	I	X	X	X	X	X	-	X	X	X	TT
4	I	X	X	X	X	X	X	X	-	X	TT
	II	-	-	-	X	-	X	-	-	-	-
175	I	X	-	-	X	X	-	X	X	-	-
Area K											
3	I	X	X	X	X	X	-	X	X	X	TT,AS
48	I	-	-	-	-	X	-	-	-	-	-
172	I	X	-	-	-	X	-	-	-	-	CH
173	I	X	-	-	-	X	-	-	-	-	-
174	I	X	-	-	-	-	-	X	-	X(UP)	-

TABLE 5.1 (Cont'd)

Area and Site	Phase[b]	FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
		Activity[c]									
Area L											
5	I	-	-	-	-	-	-	-	-	X	-
6	I	-	-	-	-	-	-	-	-	-	-
17	I	-	-	-	-	-	-	-	-	X	AT
	II	-	-	-	-	X	X	-	-	-	-
18	I	X	X	-	X	-	X	-	-	-	SG
35	I	X	-	-	-	X	-	X	X	-	TT
36	I	X	-	-	-	X	-	-	-	-	-
41	I	X	-	-	-	X	-	-	-	-	-
42	I	X	-	-	-	X	-	-	-	-	-
43	I	-	-	-	-	X	-	-	X	-	CH
	II	-	-	-	-	-	-	-	-	-	X
77	I	X	-	-	-	X	-	-	-	-	-
91	I	X	X	-	-	X	-	-	-	-	-
103	I	X	X	X	-	-	-	-	-	-	X
	II	-	-	-	-	-	-	X	X	-	-
114	I	X	-	-	-	X	-	X	-	-	-
160	I	X	-	-	-	X	-	-	-	-	-
161	I	X	-	-	-	X	X	X	X	-	-
162	I	X	X	-	-	X	X	-	-	-	-
166	I	X	-	-	-	X	-	-	-	-	-
167	I	X	-	-	-	X	-	X	X	-	-
168	I	X	X	-	-	X	-	X	X	-	-
169	I	X	X	-	-	X	-	X	X	-	-
170	I	X	-	-	-	X	-	-	-	-	-
171	I	X	-	-	-	X	-	-	-	-	-
176	I	-	-	-	-	X	-	-	-	-	-
177	I	X	-	-	-	-	X	-	-	-	X
Area M											
15	I	-	-	-	-	X	-	-	-	-	-
	II	-	-	-	-	-	X	-	-	-	-
115	I	X	-	-	-	X	-	-	-	-	-
152	I	X	-	-	-	X	X	-	-	-	-
153	I	X	-	-	-	X	-	-	-	-	-
154	I	X	-	-	-	X	-	-	-	-	-
155	I	X	-	-	-	X	-	-	-	-	-

TABLE 5.1 (Cont'd)

Area and Site	Phase[b]	Activity[c] FI	GS	UX	DS	SS	SB	SE	SW	GW	OT[d]
Area N											
7	I	X	X	X	X	X	-	X	X	-	-
8	I	X	X	X	X	X	-	-	-	-	AS
9	I	X	X	X	X	X	X	X	X	-	-
10	I	-	X	X	X	-	X	-	-	X	-
11	I	X	X	X	X	X	X	-	-	-	AS
12	I	X	X	X	X	-	X	-	-	-	-
13	I	X	X	X	X	X	-	X	X	X	-
14	I	X	X	X	X	-	X	X	X	-	AS
Area O											
54	I	-	X	X	-	-	-	X	X	-	X
164	I	X	-	-	-	X	-	-	-	-	-
Area P											
27	I	-	-	-	-	-	-	-	X	X	-
78	I	X	-	-	-	X	-	-	-	-	-
94	I	-	-	-	-	X	X	X	-	-	-
	II	-	-	-	-	-	-	-	-	-	-
119	I	X	-	-	-	X	-	-	-	-	-
120	I	X	-	-	-	X	-	X	X	-	-
121	I	X	-	-	-	X	-	X	X	-	-

[a]Table lists only those Sites for which RI activities are recommended in addition to closure plan activities.

[b]Phase II activities are listed only if they include activities unique to the Site.

[c]Activities are FI = field inspection, GS = geophysical survey, UX = UXO removal, DS = drum sampling and removal, SS = surface soil sampling, SB = soil borings, SE = sediment sampling, SW = surface water sampling, GW = groundwater sampling (by monitoring well or drive point [DP]), and OT = other.

[d]Other activities include TT = tank integrity testing or sampling, LT = line integrity testing or sampling, AT = aquifer slug tests, SG = soil gas survey, AS = air sampling, and CH = chip sampling.

TABLE 5.2 Summary of Surface Soil and Sediment Sampling Data Needs for All Sites at Picatinny Arsenal[a]

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m)		Analytic Categories[d]	Comments
			Distance	Depth		
Area B						
20	I	S/4	-	-	6	Near Site edges
24	I	SE/4	-	-	1, 2, 6, uranium	From area south of (upgradient to) and from northern drainage ditch between pond and brook
Area C						
19	I	TBD	-	-	1a, 1c	
23	I	S/TBD	-	-	1a-1e, 2, 8	Near drums in the woods
	II	TBD	-	-	TBD	Based on Phase I results
25	I	SE/2	-	-	1, 2, 3, 5, 6, 7	From brook
163	II	S/TBD	-	-	TBD	Based on Phase I results
180	I	S/TBD	-	-	1a-1e	One from each stained area
	I	S/10	15 (grid)	0.6	1a-1e	From former disposal area
	I	SE/3	-	-	1a-1e	From swampy area
Area D						
21/37	I	TBD	-	-	1a, 1c	
45	I	S/TBD	-	0-0.15	TPH, BTX	Outside doors and stained areas
69	I	S/3+	-	0.15-0.3	1a-1c, 5a, CN, SO_4	Three from each loading and handling area and one from each stained area; collect three deeper samples (0.6 m) around UST
	I	SE/2	30	-	1a-1c, 5a, CN, SO_4	From Bear Swamp Brook at former outfall

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area D (Cont'd)						
117	I	S/TBD	30	0.15-0.3	1a, 1b. 1c, uranium	Three from each loading and handling area and one composite from each stained area
.	I	SE/3	-	-	1a, 1b, 1c, uranium	From Bear Swamp Brook: one upstream, one at Site, and one downstream
118	I	SE/3	-	0-0.3	1a-1e, CN	One from brook at each pipe outlet and two from pond
122	I	S/TBD	-	0.15-0.3	1a, 1b, 2	Three from each loading and handling area and one composite from each stained area
	I	SE/3	30	-	1a, 1b, 2	From Bear Swamp Brook: one upstream, one at Site, and one downstream
123	I	S/TBD	-	0.15-0.3	1c, 5a, CN, SO_4, uranium	Three from each loading and handling area and one composite from each stained area
	I	SE/3	30	-	1c, 5a, CN, SO_4, uranium	From Bear Swamp Brook: one upstream, one at Site, and one downstream
182	I	S/TBD	-	0-0.3	1c, CN	From each stained area
183	I	S/TBD	-	-	1c, CN	One from each stained area
Area E						
28	I	SL/12	-	0-0.15	1a-1c, 1e	From secondary settling tanks
38	I	S/6	-	-	1, 6, CN	Below bottom of each tank
	II	TBD	-	-	TBD	Based on Phase I results
44	I	S/2	-	0-0.15	1a, 1b	Under gasoline tank if there is leakage
	II	S/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area F						
60	I	S/TBD	-	0-0.15	1c, CN	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
61	I	S/4	-	0.15-0.3	1c, 8, CN	Behind Bldg. 171
	I	S/4	-	0.15-0.3	1c, CN	Around Bldg. 176
	I	S/TBD	-	-	1c, 8, CN	From stained areas
	I	SE/4	-	-	1c, 2, 8	From creek near Bldg. 176
	I	SE/2	-	0-0.6	1c, 8, CN	From creek south of Bldg. 171
	II	S/TBD	-	-	TBD	Based on Phase I results
	II	SE/TBD	-	-	TBD	Based on Phase I results
104	I	S/8+	-	-	1c, 2, 8, CCl_4	From each side of each building, identified propellant dump, and stained areas
	I	SE/4+	-	-	1c, 2, 8, CCl_4	Three from swamp, one from creek downgradient from Site, and one from each building drain
	III	S, SE/TBD	-	-	TBD	Based on Phase II results
106	I	S/8+	-	0.15-0.3	1e, 5a, 8	One sample from each side of building location and transformer storage area; one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results sampling
111	I	S/10+	-	0-0.15	8	Two from each side of Bldg. 455 and 454 loading areas
	I	S/TBD	-	0-0.6	8	From each stained area
	I	SE/TBD	-	0-0.3	8	From each drain outfall
	II	S/TBD	-	-	TBD	Based on Phase I results
124	I	S/TBD	-	0-0.3	2, 8	From stained areas around Bldg. 166
	I	S/1	-	0-0.3	1e	Composite from near PCB transformer

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area F (Cont'd)						
125	I	S/8+	-	0-0.3	1b, 1c, 5a, SO_4	Eight from around Bldgs. 172 and 183 and one from each stained area
	I	S/2	-	0-0.3	1e	Composite from near two PCB transformers
126	I	S/TBD	-	0-0.3	8	From stained areas around Bldg. 197
138	I	S/4+	-	0-0.6	1a, 1c, 2, 8	From each side of Bldg. 407 and each stained area
	I	SE/4+	-	-	1a, 1c, 2, 8	One from each settling basin near Bldg. 408, two from swamp, and one from each drain outfall
	I	S/1	-	0-0.3	1e	Composite from near PCB transformer at Bldg. 404
	II	S/TBD	-	-	1a, 1c, 2, 8	Based on Phase I results
139	I	S/TBD	-	0-0.6	8	One from bottom of each located decontamination pit
	I	SE/2	-	0-0.3	8	From swamp behind building
140	I	S/4+	-	0-0.3	2, 8	Four around Bldg. 427 and one from each stained area
	I	SE/5	-	0-0.3	2, 8	From open drain around buildings and concrete pit near Bldg. 427
	I	SE/1	-	-	1a, 1b, 2, 8, acetone, ethyl acetate	Grab sample from catch tank in Bldg. 427
	II	S/TBD	-	-	TBD	Based on Phase I results
141	I	S/TBD	-	0-0.3	8	From each stained area
	I	SE/1	-	0-0.3	1a-1c, 8	From bottom of each catch tank
142	I	S/TBD	-	-	8, 5a, chloride, ethyl acetate, acetone	From each stained area
	II	SE/TBD	-	-	8, 5a, chloride, ethyl acetate, acetone	One from each drain outfall

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Sampling Interval (m) Depth	Analytic Categories[d]	Comments
Area F (Cont'd)						
143	I	S/TBD	-	-	8	From each stained area
	I	SE/TBD	-	-	8	From each located drain outfall
144	I	S/TBD	-	-	2, 8	From each stained area
	I	SE/TBD	-	-	2, 8	One from each drain or drain outfall (if located)
145	I	S/4+	-	0-0.3 or 0-0.6	1c, 2, 8	Four around Bldg. 477, one from each stained area, and from any waste dumps
	I	SE/TBD	-	0-0.3	1c, 2, 8	Two from bottom of sand filter (if located), two near drainage receiving effluent, and one from each drain outfall
	II	S/TBD	-	-	TBD	Based on Phase I results
146	I	S/4+	-	-	8	Four around Bldg. 497 and, if possible, two from under building
	I	SE/TBD	-	0-0.3	8	One from each drain outfall
	II	S/TBD	-	-	TBD	Based on Phase I results
Area G						
31	I	S/TBD	-	0-0.15	1c, 1d, TPH	One from each stained area and one from each loading and handling area
52/95	I	S/10	-	0.15-0.3	1c, 1d, TPH	From points evenly distributed across brook area
96	I	S/8+	-	0.15-0.3	1a, 1b, 1e	Four from perimeters of each building, three from each storage area, and one composite from each stained area
101	I	S/10+	-	0.15-0.3	1a, 1b, 1c, 2, 5	Ten from burning ground area, six from disposal pit area (if located), and one composite from each stained area

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area G (Cont'd)						
134	I	S/TBD	-	0-0.6	1a-1c, 2, 5	Three from each storage area, one 0.6 m from disposal pit (if located), and one composite from each stained area
135	I	S/TBD	-	0.15-0.3	1a, 1b, 2, 5a, SO_4	Three from each loading and handling area and
136	I	S/TBD	-	0.15-0.3	1a-1c, 5a, SO_4	Three from each loading and handling area and one composite from each stained area
Area H						
55	I	S/16	-	-	1a, 1b, 2, 5	Two from each of four sides of Bldgs. 221 and 223
	I	S/TBD	3 (grid)	0-0.15	1a, 1b, 2, 5	Under raised flow trough between Bldgs. 225 and 232 and around holding tank near Bldg. 225
	I	S/5+	-	0-0.15	1a-1e, 2, 5	Area under discharge point in Bear Swamp Brook
62	I	S/TBD	-	0.3	1a, 1b, 1e, 2, 5, SO_4	Three from each loading and handling area and one from each stained area
	I	SE/2	-	-	1a, 1b, 1e, 2, 5, SO_4	From former outfall location in Bear Swamp Brook
64	I	S/TBD	-	0.15-0.3	1a, 1b, 1e, 2, 5, SO_4	Three from each loading and handling area and one from each stained area
	I	SE/2	-	-	1a, 1b, 1e, 2, 5, SO_4	From Bear Swamp Brook at former outfall
98	I	S/TBD	-	0.15-0.3	1a, 1b, 2, 5	Three from each loading and handling area and one composite from each stained area
100	I	S/10+	-	0.15-0.3	1a, 1b, 1e, 2, 5	Ten from former building location and one composite from each stained area
	I	SE/2	-	-	1a, 1b, 1e, 2, 5	From Bear Swamp areas convenient for dumping

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m)		Analytic Categories[d]	Comments
			Distance	Depth		
Area H (Cont'd)						
127	I	S/4+	-	0.15-0.3	2, 5	Three from each loading and handling area, one from each side of building, and one composite from each stained area
128	I	S/8+	-	0.15-0.3	2, 5	Three from each loading and handling area, one from each side of two buildings, and one composite from each stained area
130	I	S/4+	-	0.15-0.3	2, 5, 8	Three from each loading and handling area, one from each side of building, and one composite from each stained area
131	I	S/TBD	-	0.15-0.3	1a, 1b, 1e, 2, 5, SO_4	Three from each loading and handling area and one composite from each stained area
132	I	S/28+	-	0.15-0.3	1a, 2, 5, 8	Three from each loading and handling area, one from each side of each building, and one composite from each stained area
151	I	S/4+	-	0.15-0.3	2, 8	One from each side of Bldg. 600 and one from each stained area
Area I						
16	I	S/TBD	-	0-0.15	2	Collect when line excavation begins
30	I	S/4	-	0-0.15	1a-1c, 4, 5, chloride, fluoride, bromide	Around building and on roof embankment
	II	S/TBD	-	-	TBD	Based on Phase I results
32	I	S/14	-	0.15-0.3	1a, 1b, 5, NC	Under the filling or discharge points for each tank and along northwest side of Bldg. 553
	I	S/3	-	0.15-0.3	1a, 1b, 5, NC	Under pipeline
	II	S/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area I (Cont'd)						
33	I	S/2	-	0.15-0.3	1a, 2	From area between Bldg. 527A and Picatinny Lake
	II	S/TBD	-	-	TBD	Based on Phase I results
40	I	SE/6	-	0-0.15	1c, 2, 4, 5	Three from ditch, two along lakeshore, and one from pipe drain
	I	S/TBD	-	0-0.15	1c, 2, 4, 5	From area between Bldgs. 809 and 810, from areas of disturbed or stained soil, and from possible spill areas
47	I	S/3	-	0.15-0.3	1b, 1c, 1e, O&G	Around storage area behind Bldg. 3005
	I	S/TBD	-	0.15-0.3	1b, 1c, 1e, O&G	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
50	I	S/4+	-	0.3	1a-1c, 2	One from each stained area and one from each side of Bldg. 519
	I	SE/TBD	-	-	1a-1c, 2	One from each sump
	II	S/TBD	-	-	TBD	Based on Phase I results
53	I	S/TBD	30 (grid)	0-0.15	1a-1c, 2	On island in lake, especially from stained soil
	I	SE/10+	-	0-0.3	1a-1e, 2, 3, 4, 5, CN, Mirex, fluoride,	From lake bottom; choose locations to avoid disturbing UXO
	II	SF/TBD	-	-	TBD	Based on Phase I results
70	I	S/TBD	-	0-0.3	1a-1c, 2	One from each stained area
71	I	S/TBD	-	0-0.3	1c, 2, 8	One from each stained area
	III	SE/2	-	0-0.3	1c, 2, 8	From Picatinny Lake shore near borings; based on Phase II results
79	I	S/TBD	-	0-0.3	1a, 1b	Near southwest corner of Bldg. 3013 and one from each stained area

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area I (Cont'd)						
82	I	S/3	-	0-0.3	1b, silver	Two along outflow path and one from discharge point
	II	SE/2	-	0.3	1b, silver	From shore of Picatinny Lake along outflow path; based on Phase I results
83	I	S/TBD	-	0-0.3	1a-1c, 2	One from each stained area
	I	S/2	-	0-0.3	1c, 2, 5, 8, SO_4	If pit can be located and it is uncovered
90	I	S/TBD	-	0-0.15	1a, 1b	One from each stained area
93	I	S/2	-	0-0.3	2, 8	Two from powder disposal area, if located
	III	SE/2	-	0.3	2, 8	From Picatinny Lake near borings; based on Phase I results
97	I	S/4+	-	0-0.15	1b, mercury	Four from building perimeter, one composite from each stained area
102	I	S/TBD	-	0-0.3	1a, 1b, lead	From stained areas behind ceramic shop and over hill
105	I	S/4+	-	0.15-0.3	1e	One from each side of building location and one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
108	I	S/4	-	0-0.3	1c	Four along perimeter of Bldg. 717
	I	S/5+	-	0-0.3	1a-1c, 2	Four along the perimeters of Bldgs. 722 and 723 (two per building), one from flare testing room, and from any dump and flare areas
	I	S/2	-	0-0.3	1c, 2, fluoride	From concrete pit
	III	SE/TBD	-	0-0.3	1a-1c. 2	From Green Pond Brook and Picatinny Lake; based on Phase II results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area I (Cont'd)						
109	I	S/4+	-	-	1c, 2, 5a, 8	From each side of Bldg. 445 and from each stained area
	I	SE/TBD	-	-	1c, 2, 5a, 8	From any building sump or drain outfall
113	I	S/4+	-	0-1.5	1a-1c, 2	One from each stained area
137	I	S/TBD	-	0-0.8	1a-1e, 2	Three 0.8 m from disposal pit (if located) and one composite from each stained area
147	I	S/4+	-	0.15-0.3	1b, 1c, 8	One from each side of Bldg. 520 and one from each stained area
148	I	S/TBD	-	0.15-0.3	1a-1c, 2	One from each stained area
149	I	S/4+	-	0.15-0.3	1b, 2	One from each side of Bldg. 541 and one from each stained area
150	I	S/4+	-	0.15-0.3	2, 8	One from each side of Bldg. 555 and one from each stained area
	I	SE/TBD	-	-	2, 8	From drain pipes in building
	II	S/TBD	-	-		Based on Phase I results
156	I	S/TBD	-	0-0.3	1c, 2, 8	One from each stained area
	I	SE/4	-	0.3	1c, 2, 8	Behind Bldgs. 813, 816, and 818B along shore of Picatinny Lake
157	I	S/4	-	0-0.3	1c, 2, 8	Between Bldgs. 820 and 823 and Picatinny Lake
	II	SE/2	-	0.3	1c, 2, 8	From Picatinny Lake; based on Phase I results
158	I	SE/2	-	0.3	2, 8, lead	From Picatinny Lake near Bldg. 926
	II	SE/TBD	-	0.3	2, 8, lead	Based on Phase I results
159	II	SE/2	-	0.3	Lead	From Green Pond Brook; based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area I (Cont'd)						
178	I	S/8+	-	0-0.3	1a-1c, 2	One from center of each side of Bldgs. 541 and 561 and one from each stained area
	I	S/4+	-	0-0.3	1a, 1b, 2	One from center of each side of Bldg. 323A and one from each stained area
	I	S/4+	-	0-0.3	1a, 1b, lead	One from center of each side of Bldg. 1052 and one from each stained area
	II	S, SE/TBD	-	-	TBD	From each located drainline
184	I	S/TBD	-	0.15-0.3	1a-1c, 1e, 2	One from each stained area
Area J						
1	I	S/6	-	0-0.3	1a, 1b, 2, chromium, lead, phthalates	Around structures, stained areas, etc.
	I	S/2	100	0-0.15	1a, 1b, 2, chromium, lead, phthalates	From each channel carrying runoff
	II	TBD	-	-	TBD	Based on Phase I results
2	I	S/12	-	0-0.3	1b, 1c, 2, 4, 5a, CN, fluoride	Around structures, pads, tanks, spill areas, building sump, etc.
	I	SE/7	-	-	1b, 1c, 2, 3, 4, 5a, CN, fluoride	From three locations in reservoir, two in pond, and one in each of two streams
	II	TBD	-	-	TBD	Based on Phase I results
4	I	S/2	15 (grid)	0-0.3	1e	Near PCB transformers in Bldg. 3602
	I	S/4	-	0-0.3	1b, 1c, 2, 5a, 8, fluoride, aniline	Behind each of Bldgs. 3603, 3604, 3606, and 3607
	I	SE/2	-	0.6 or basin bottom	1a-1e, 2, 3, 5, 8, fluoride	Two locations in catch basin near Bldgs. 3601 and 3607
	I	SE/2	-	0.15	1a, 1b, 1c, 2, 3, 5, 8, fluoride	Two locations in pond north of Bldg. 3618

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area J (Cont'd)						
175	I	S/TBD	-	-	1a, 1b	Around drums if leakage is apparent and from each stained area
	I	S/TBD	-	0-0.3	1a, 1b	From each stained area
	I	SE/2	-	0-0.3	1a, 1b	From swamp
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
Area K						
3	I	S/6	-	0-0.3	1b, 1c, 1e, 2, 3, 4, 5a, CN, fluoride	From stained area and behind test stands
	I	S/1	-	0-0.3	1a-1c, 2, 5a, fluoride	From waste storage pallet area
	I	S/2	-	0-0.3	1a-1c	NNE end of Bldg. 1518
	I	SE/7	-	0-0.15	1a-1c, 1e, 2, 3, 4, 5a, CN, fluoride	Four from reservoir, two from ditch, and one each near locations SD3-2 and SD3-3
	II	TBD	-	-	TBD	Based on Phase I results
48	I	S/TBD	-	0-0.3	1a, 1b, lead, chromium	From under drain pipes, stained soil, and around pallets
	II	S/TBD	-	-	TBD	Based on Phase I results
172	I	S/TBD	-	0-0.3	1e	Four from each oil-stained area adjacent to parking area
173	I	S/TBD	-	0-0.3	1a-1c, 2	One from each stained area
174	I	SE/6	-	-	1a-1c, 1e, CN	Two from each holding bed
	II	SE/TBD	-	-	6	Based on Phase I results
Area L						
17	II	S/2	-	-	1a-1c, 2, 5, NH_3, SO_4	Downgradient of tetryl pits
18	II	S/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area L (Cont'd)						
35	I	S/TBD	-	0.15-0.3	1c, 2, 5a, SO_4	One from each stained area
	I	SE/2	-	-	1c, 2, 5a, SO_4	From catch basin and stagnant pool quarterly for one year
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
36	I	S/4+	-	0-0.15	1a-1c, 2, 5a, 8, CN	From loading platform, parking area, surface drainage, and stained areas
41	I	S/4+	-	0-0.15	1, 4, 6	From parking area, loading area, outfalls, and stained areas
42	I	S/2	-	0-0.15	1a-1c, 1e, 2, 6, 8, uranium	From south side of parking area, near building foundation, adjacent surface drainage, and stained areas
	I	S/4	-	-	1a-1c, 1e, 2, 6, 8, uranium	Below paved area
	I	S/TBD	-	-	1a-1c, 1e, 2, 6, 8, uranium	From discolored areas, ditches, or outfalls
43	I	S/3	15	0-0.15	1c, 1d, 4, Mirex, CN	Along drainage ditch beginning at pad
	II	S/TBD	-	-		Based on Phase I results
77	I	S/TBD	-	0-0.3	1a-1c	One from each stained area
91	I	S/5	-	0-0.3	2, lead	Three from washout area and two from area adjacent to waste storage walkway
103	II	SE/TBD	-	0.3	2, lead	Based on results of UXO survey
114	I	S/TBD	-	0-1.5	2	One from each stained area
	I	SE/4	30	-	2	From Robinson Run
	II	S, SE/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area L (Cont'd)						
160	I	S/TBD	-	0-0.15	2, 8, tetrahydrofuran	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
161	I	S/4+	-	0.15-0.3	1a-1c, 2	One from each side of Bldg. 1031 and one from each stained area
	I	SE/2	-	-	1a-1c, 2	From swamp behind building
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
162	I	S/4+	-	0-0.15	1a, 1b, 2	One from each side of Bldg. 1071 and one from each stained area
166	I	S/TBD	-	0-0.15	2	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
167	I	S/TBD	-	0-0.15	2	One from each stained area
	I	SE/TBD	-	-	2	One from each sump in Bldg. 1373
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
168	I	S/TBD	-	0-0.15	1a-1c, 2, 8	One from each stained area and one from each outfall area
	I	SE/TBD	-	-	1a-1c, 2, 8	One from each sump in Bldgs. 1400 and 1403 and one from each drainpipe outlet
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
169	I	S/TBD	-	0-0.15	1a-1c, 2, 8	One from each stained area
	I	SE/2+	-	0-0.3	1a-1c, 2, 8	Two from swamp behind Bldgs. 1408A and 1408B, one from each sump or catch basin, and one from each drainpipe outlet
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
170	I	S/8+	-	0-0.3	2	Two near each of four sump tanks and one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area L (Cont'd)						
171	I	S/TBD	-	0-0.3	1a, 1b, lead	One from each stained area
176	II	S/TBD	-	-	TBD	Based on Phase I results
Area M						
15	I	S/5	-	0-0.15	1a, 2, 8, uranium	2.4- by 2.4-m area under test stand
	I	S/TBD	-	0-0.15	1a, 2, 8, uranium	Drum bases, etc. in detonation area
	I	S/TBD	-	0-0.15	1a, 2, 8, uranium	Around each sandpile in firing area
115	I	S/TBD	-	0-1.5	2	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
152	I	S/8+	-	0.15-0.3	1c, 2	One from each side of storage area and catch basin and one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
153	I	S/TBD	-	0-0.15	1a-1c	One from each stained area
	II	S/TBD	-	-		Based on Phase I results
154	I	S/4+	-	0.15-0.3	1a-1c, 2	One from each side of Bldg. 617 and one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
155	I	S/TBD	-	0-0.15	1a-1c, 2, 8	One from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
Area N						
7	I	S/4+	15 (grid)	-	1c, 2, 3, 5, 8	From firing area and stained areas
	I	SE/3	-	-	1c, 2, 3, 5, 8	Along Green Pond Brook
	II	S/TBD	-	-	TBD	Based on Phase I results

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area N (Cont'd)						
8	I	S/10	≥23 (grid)	0.15-0.3	1a-1c, 2, 3, 5, 8	Ten from southeast part of Site and one from each stained area
	I	S/12	-	-	1a-1c, 2, 3, 5, 8	From sandpiles near SE corner of Site
	II	S/TBD	-	-	TBD	Based on Phase I results
9	I	S/5+	-	0.15-0.3	1c, 2, 3, 5, 8, SO_4	Two from south of Bldg. 673; one near each of SS9-4, SS9-5, SS9-1, and SS9-3; and one from each stained area
	I	SE/3	-	-	1c, 2, 3, 5, 8, SO_4	From unnamed stream crossing Site
	II	S/TBD	-	-	TBD	Based on Phase I results
11	I	S/9+	-	0.15-0.3	1c, 2, 3, 5, 8	Four between Bldg. 647 and SS11-3 and SS11-4, one north of impact area, near Bldgs. 649 and 650 and burn cage, and one from each stained area
	II	S/TBD	-	-	TBD	Based on Phase I results
13	I	S/4+	-	0.15-0.3	1b, 1c, 2, 5, 8	Two from northeast side, one from northwest side, one between Bldg. 640 and swamp, and one from each stained area
	I	SE/2	-	-	1b, 1c, 2, 5, 8	From swamp
	II	S, SE/TBD	-	-	TBD	Based on Phase I results
14	I	S/5	-	0.15-0.3	1c, 2, 3, 5, 8, SO_4	From area between firing area and bunker
	I	S/9	-	-	1c, 2, 3, 5, 8, SO_4	Three from each sand pile in wetlands; from disturbed areas
	I	SE/2	-	-	1c, 2, 3, 5, 8, SO_4	From pond
Area O						
54	I	SE/10	-	-	1a-1e, 2, 3, 4, 5, uranium	Choose locations to avoid disturbing UXO
	II	SE/TBD	-	-	TBD	Based on Phase I results
164	I	S/TBD	-	0-0.3	2, 5, 8	One from each stained area

TABLE 5.2 (Cont'd)

Area and Site	Phase	Type[b]/No. of Samples[c]	Sampling Interval (m) Distance	Depth	Analytic Categories[d]	Comments
Area P						
78	I	S/3+	-	0.15-0.3	1a-1c, 5a, SO_4	Three from each loading and handling area and one from each stained area
94	I	S/TBD	-	0-0.3	1a-1c, 2, 3	Near exits, perimeters, and from stained areas around four buildings
	I	S/1	-	0-0.3	1a-1c, 2, 3	From bottom of dry well outside Bldg. 1601, if well is uncovered
	I	SE/2	-	0.3	1a-1c, 2, 3	From lagoon north of Bldg. 1604
	II	SE/TBD	-	0.3	1a-1c, 2, 3	Based on Phase I results
119	I	S/3+	-	0-0.3	8	Three from entrance of each building and one from each stained area
	II	S/TBD	-	0-0.3	8	Based on Phase I results
120	I	S/TBD	-	0-0.3	8	From reported spill areas and one from each stained area
	I	SE/1	-	0-0.3	8	From unnamed ditch southeast of Bldg. 50
121	I	S/1+	-	0-0.3	1a, 1c	One from building entrance and one from each stained area
	I	SE/1	-	0-0.3	1a, 1c	From unnamed ditch southeast of Bldg. 57
	I	S/1	-	0-0.3	1e	Composite from near PCB transformer

[a]Only Sites for which the sampling plan specifies soil and sediment sampling are included.

[b]S = surface soil, SE = sediment, SL = sludge, and TBD = to be determined.

[c]See Volume 2 for figures showing sampling locations.

[d]The categories are as follow ... : = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives; 3 = gross alpha and beta; 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability; 6a = TCLP metals, and 8 = propellants. Other abbreviations are BTX = benzene, toluene, and xylene; CCl_4 = carbon tetrachloride; CN = cyanide; NC = nitrocellulose; NH_3 = ammonia; O&G = oil and grease; TBD = to be determined; TPH = total petroleum hydrocarbons; and SO_4 = sulfate.

TABLE 5.3 Summary of Soil Boring Sampling Needs for All Sites at Picatinny Arsenal[a]

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area C					
163	I	TBD	B/G	1, 2, 8	One at center of each EM anomaly
Area D					
182	II	TBD	B/G	1c, CN	Based on Phase I results
183	II	TBD	-	TBD	Based on Phase I results
Area E					
44	II	TBD	-	1d, 4	Based on USAEHA results
Area F					
60	II	TBD	-	1a, 1c, CN	Based on Phase I results
61	II	TBD	-	1c, 2, 8, CN	Based on Phase I results
104	I	1	-	1c, 2, 8, CCl_4	Drill near lime pit, if located
	II	TBD	-	TBD	Based on Phase I results
	III	TBD	-	TBD	Based on Phase I results
106	II	TBD	-	1e, 5a, 8	Based on Phase I results
111	II	TBD	B/G	8	Based on Phase I results
124	II	TBD	-	TBD	Based on Phase I results
125	II	TBD	-	TBD	Based on Phase I results
139	I	TBD	Bottom of pit + 2	8	At each located covered pit
	II	TBD	B/G	8	Based on Phase I results

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area G					
31	I	8	G	1	One soil boring each at locations SS31-1 to SS31-6, SS31-8, and SS31-10
52/95	I	TBD	3 or G	1, 2, 6	From swampy area and former pond bed; based on results of surface soil sampling
Area H					
62	II	TBD	3 or G	TBD	Based on Phase I results
151	II	TBD	-	TBD	Based on Phase I results
Area I					
50	I	3	B/G	1a	Two downgradient and one upgradient
	I	2	G	1a	Collect during well installation
63/65	I	TBD	0.9-1.5	1a-1c, 1e, O&G	One at center of each stained area
	I	1	B/G	1a-1c, 1e, O&G	Between concrete pad and Picatinny Lake
	II	TBD	-	TBD	Based on Phase I results
70	II	TBD	B/G	1a-1c, 2	Based on Phase I results
71	II	2	B/G	1c, 2, 8	Between Bldg. 910 and Picatinny Lake; based on Phase I results
79	II	TBD	B/G	1a, 1b	Based on Phase I results
83	I	1	B/G	1c, 2, 5, 8, SO_4	If pit is covered
	II	TBD	B/G	1a-1c, 2	Based on Phase I results
93	I	TBD	B/G	2, 8	At center of each located pit
	II	2	B/G	2	One between each building (800 and 807) and Picatinny Lake

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area I (Cont'd)					
102	I	1	B/G	1a-1c	At rack area
	II	TBD	B/G	1a-1c	Based on Phase I results
108	II	3	B/G	1a-1c, 2	Two between Picatinny Lake and Bldg. 717 and one between Bldg. 722 and Green Pond Brock if surface soils are contaminated
109	II	TBD	-	TBD	Based on Phase I results
	III	TBD	-	TBD	Based on Phase II results
113	I	2	B/G	1a-1c, 2	One each from east and west sides of Bldg. 561
	II	TBD	-	TBD	Based on Phase I results
147	I	TBD	B/G	1a-1c, 2, 8	One at center of each disposal pit, if found; one within 9 m of Bldg. 520 (north side)
	II	TBD	-	TBD	Based on Phase I results
149	I	1	B/G	1a, 1b, 2	Downslope from Bldg. 541
	II	TBD	-	TBD	Based on Phase I results
150	I	1	B/G	2, 8	At center of west side of Bldg. 555
	II	TBD	-	TBD	Based on Phase I results
156	I	2	B/G	1c, 2, 8	Near each building and between Bldgs. 816 and 813 and Picatinny Lake
	II	TBD	-	1c, 2, 8	Based on Phase I results
157	I	2	B/G	1c, 2, 8	Near Bldgs. 820 and 823
159	I	2	B/G	Lead	In area of disturbed soil or buried metal, if found
178	II	TBD	B/G	1a-1c, 2	Based on Phase I results

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area J					
1	II	5	B/G	1a, 1b, 2, chromium lead, phthalates	In the dump area, if located
				1c	Analyze three above samples with highest contaminant values
2	I	2	B/G	1a, 1b	Spill areas near Bldgs. 3513 and 3541
	I	1	B/G	1a-1c, 5a, fluoride	Sump area near Bldg. 3521
	II	TBD	-	TBD	Based on Phase I results
4	I	2	B/G	1-1c, 2, 3, 5, 8, fluoride	One near north end of Bldg. 3618 and one near well M
	II	TBD	-	TBD	Based on Phase I results
Area K					
173	II	TBD	B/G	1a-1c, 2	In center of each contaminated area, if any
Area L					
17	II	4	B/G	1a-1c, 2, 5, NH_3, SO_4	In center of pits
	II	TBD	-	TBD	Based on Phase I results
18	I	TBD	B/G	1a-1c, 2, 5, NH_3, SO_4	Begin sampling at apparent pit bottom
	II	TBD	-	TBD	Based on Phase I results
	II	TBD	-	TBD	Based on Phase I results
36	II	TBD	-	TBD	Based on Phase I results
41	II	TBD	-	TBD	Based on Phase I results
42	II	TBD	-	TBD	Based on Phase I results

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area L (Cont'd)					
77	II	TBD	B/G	1a-1c	Based on Phase I results
91	II	TBD	B/G	2, 8, lead	Based on Phase I results
160	II	TBD	-	TBD	Based on Phase I results
161	I	1	B/G	1a-1c, 2	About 50 ft downslope from building
	II	TBD	-	TBD	Based on Phase I results
162	I	TBD	line + 0.9-1.5	2	Two borings near leach field lines, if located
	II	TBD	-	TBD	Based on Phase I results
169	II	TBD	-	TBD	Based on Phase I results
171	II	TBD	B/G	1a-1c	In center of each contaminated area, if any
176	I	TBD	B/G	1, 2, 4, 8, CN	One at center of each EM anomaly
177	I	12	pipe bottom + 0.6	1a-1c, 2, 8	Eight near pipes in Subbasins 6 and 7; four outside the subbasins and downstream from Bldgs. 95 and 24
	II	TBD	pipe bottom + 0.6	1a-1c, 2, 8	Based on Phase I results
	III	TBD	pipe bottom + 0.6	1a-1c, 2, 8	Based on Phase I and II results
Area M					
15	II	TBD	-	TBD	Based on Phase I results
152	I	2	Tank or basin bottom + 1-1.5	1c, 2	One between tanks after their removal and one beside catch basin
	II	TBD	-	TBD	Based on Phase I results

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area M (Cont'd)					
155	II	TBD	-	TBD	Based on Phase I results
Area N					
8	I	4	B/G	1a-1c, 2, 3, 5, 8	In southeast part of Site
	II	TBD	-	TBD	Based on Phase I results
9	I	5	B/G	1c, 2, 3, 5, 8, SO_4	At contaminated surface soil sampling locations
	I	3	B/G	1c, 2, 3, 5, 8, SO_4	Near and just off edge of Site
	II	TBD	-	TBD	Based on Phase I results
10	I	3	pit bottom + 0.3	1a-1e, 2, 3, 4, 5, 8, CN, fluoride, fluoroacetate	One in pit, one 2.4 m northwest of pit, and one 2.4 m southeast of pit
	II	TBD	-	TBD	Based on Phase I results
11	I	2	B/G	1c, 2, 3, 5, 8	One each beside sampling locations SS11-1 and SS11-2 and one near SS11-7
	II	TBD	-	TBD	Based on Phase I results
12	I	3	B/G	1c, 2, 3, 5, 8	One near sediment sampling location SD12-1, one near Bldg. 656, and one just east of SS12-1
	I	3	pit bottom + 0.3	1c, 2, 3, 5, 8	In pit, if it can be located
	II	TBD	-	TBD	Based on Phase I results
13	I	1	G	1b, 1c, 2, 3, 5, 8	During installation of monitoring well
14	I	4	B/G	1c, 2, 3, 5, 8, SO_4	At contaminated surface soil sampling locations
	II	TBD	-	TBD	Based on Phase I results

TABLE 5.3 (Cont'd)

Area and Site	Phase	No. of Borings	Boring Depth[b] (m)	Analytic Categories[c]	Comments
Area O					
164	II	TBD	B/G	2, 5, 8	In center of each contaminated area, if any
Area P					
94	I	1	B/G	1a-1c, 2, 3	In dry well, if it is filled up
	II	TBD	B/G	1a-1c, 2, 3	Based on Phase I results
119	II	TBD	-	8	Based on Phase I results
120	II	TBD	-	8	Based on Phase I results
121	II	TBD	-	TBD	Based on Phase I results

[a]Table lists only those Sites for which soil borings are specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]B/G = to bedrock or groundwater, whichever comes first, G = to groundwater.

[c]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semi-volatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives; 3 = gross alpha and gross beta; 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability tests; 6a = TCLP metals; and 8 = propellants. Other abbreviations are CN = cyanide, CCl_4 = carbon tetrachloride, O&G = oil and grease, NH_3 = ammonia, SO_4 = sulfate, TBD = to be determined, and TPH = total petroleum hydrocarbons.

TABLE 5.4 Summary of Surface Water Sampling Needs for All Sites at Picatinny Arsenal[a]

Area and Site	Phase	No. of Samples	Frequency[b]	Analytic Categories[c]	Comments
Area B					
24	I	4	S	1, 2, 3, uranium	Two from southern drainage ditch upgradient from Site and two from northern drainage ditch between pond and brook
Area C					
25	I	2	4Q	1, 2, 3, 5, 7	From locations SW25-1 and SW25-2 on Green Pond Brook
	II	TBD	-	TBD	Based on Phase I results
180	I	3	S	1a-1e	From swampy area
Area D					
69	I	3-5	S	1, 5a, CN, SO_4	Two from former outfall location in Bear Swamp Brook and one to three from each drainage ditch or gully on Site
117	I	3	S	1a, 1b, 1c, uranium	From Bear Swamp Brook
118	I	2	S	1a, 1b, 1c, 1e, CN	From oil-water separator pond
122	I	3	S	1a, 1b, 2	From Bear Swamp Brook
123	I	3	S	1c, 5a, CN, SO_4, uranium	From Bear Swamp Brook
Area F					
60	II	TBD	-	TBD	Based on Phase I results
61	I	4	S	1c, 2, 8	From area between Bldgs. 176 and S406
	I	2	S	1c, 8	From creek south of Bldg. 171

TABLE 5.4 (Cont'd)

Area and Site	Phase	No. of Samples	Frequency[b]	Analytic Categories[c]	Comments
Area F (Cont'd)					
104	I	4	S	1c, 2, 8, CCl_4	One from creek downgradient from Bldgs. 161 and 162 and three from swamp
	III	TBD	-	TBD	Based on Phase II results
138	I	2	S	1a, 1c, 2, 8	From swamp near Bldg. 408
	II	TBD	-	1a, 1c, 2, 8	Based on Phase I results
Area H					
62	I	2	S	1a, 1b, 1e, 2, 5, SO_4	Two from former outfall location in Bear Swamp Brook
64	I	2	S	1a, 1b, 1e, 2, 5, SO_4	Two from former outfall location in Bear Swamp Brook
100	I	2	S	1a, 1b, 1e, 2, 5	From Bear Swamp Brook in areas convenient for waste disposal
Area I					
53	I	10	S	1a-1e, 2, 3, 4, 5, 7, CN, Mirex, fluoride	From Picatinny Lake; sample entire water column
	II	TBD	4Q	1a, 1c, 2, 5, fluoride, other[d]	Near drinking water intakes and unremoved dangerous items
108	III	TBD	S	1a-1c, 2	One to three from Green Pond Brook; based on Phase II results
159	II	2	-	Lead	From Green Pond Brook near contaminated boring locations
Area J					
1	I	TBD	-	1a, 1b, 2, lead, chromium, phthalates	From two locations 100 m apart in each channel or containing water
2	I	2	4Q	1b, 1c, 2, 3, 4, 5a, CN, fluoride	From two locations in pond; sample entire water column

TABLE 5.4 (Cont'd)

Area and Site	Phase	No. of Samples	Frequency[b]	Analytic Categories[c]	Comments
Area J (Cont'd)					
4	I	TBD	S&S	1a-1e, 2, 3, 5, 8, fluoride	From catch basin, if water is present
175	I	2	S	1a, 1b	From swamp receiving effluent from building
	II	TBD	-	TBD	Based on Phase I results
Area K					
3	I	7	4Q	1c, 1d, 1e, 2, 3, 5a, 7, CN, fluoride, TPH	Three from reservoir, two from eastern drainage ditch, and one each from locations SW/SD3-2 and SW/SD3-3
	I	1	-	SO_4	From location SW/SD3-4
Area L					
18	III	TBD	-	TBD	Based on Phase I and II results
35	I	2	S	1c, 2, 5a, SO_4	One from catch basin outside Bldg. 1361A and one from stagnant water pool near Bldg. 1364
	II	TBD	-	TBD	Based on Phase I results
43	I	2	S&S	1c, 1d, 4, CN, Mirex, fluoride	From ditch when runoff is present; one near pad and one 100 m downstream
	II	TBD	-	TBD	Based on Phase I results
103	II	TBD	S	2, lead	Near any located UXO, four samples per item
161	I	2	S	1a-1c, 2	From swamp behind Bldg. 1031
	II	TBD	-	TBD	Based on Phase I results
168	I	3	-	1a-1c, 2, 8	One from each building sump
169	I	8+	S	1a-1c, 2, 8	One from each building sump, catch basin, or holding tank

TABLE 5.4 (Cont'd)

Area and Site	Phase	No. of Samples	Frequency[b]	Analytic Categories[c]	Comments
Area N					
7	I	3	4Q	1c, 2, 3, 5, 7, 8	From Green Pond Brook
9	I	3	4Q	1c, 2, 3, 5, 8, SO_4	From unnamed stream that crosses Site
	II	TBD	-	TBD	Based on Phase I results
13	I	2	4Q	2	From swamp
	II	TBD	-	TBD	Based on Phase I results
14	I	2	4Q	1c, 2, 3, 5, 8, SO_4	From pond
	II	TBD	-	TBD	Based on Phase I results
Area O					
54	I	10	4Q	1a-1e, 2, 3, 4, 5, 7	From Lake Denmark
	II	TBD	-	TBD	Based on Phase I results
Area P					
27	I	1	4Q	7, cyanide	Location 6 m downstream from Site
94	II	TBD	S	1a-1c, 2, 3	One to three from lagoon if Phase I sediment samples are contaminated
119	II	TBD	-	8	Based on Phase I results

TABLE 5.4 (Cont'd)

Area and Site	Phase	No. of Samples	Frequency[b]	Analytic Categories[c]	Comments
Area P (Cont'd)					
120	I	1	S	8	From unnamed ditch southeast of Bldg. 50
	II	TBD	-	TBD	Based on Phase I results
121	I	1	S	1a, 1c	From unnamed ditch southeast of Bldg. 57
	II	TBD	-	TBD	Based on Phase I results

[a]Table lists only those Sites for which surface water sampling is specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]S = single sample, 4Q = sample quarterly for one year and review results, S&S = sample during spring and summer when water is present.

[c]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives; 3 = gross alpha and beta; 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability; 6a = TCLP metals; 7 = macroparameters; and 8 = propellants. Other abbreviations are CCl_4 = carbon tetrachloride, CN = cyanide, SO_4 = sulfate, TBD = to be determined, TPH = total petroleum hydrocarbons.

[d]Denotes any other analytes detected in single water sample.

TABLE 5.5 Summary of Groundwater Monitoring Needs for All Sites at Picatinny Arsenal[a]

Area and Site	Phase	No. of Wells/ Type[b]	Fre- quency[c]	Analytic Categories[d]	Comments
Area B					
24	I	3/S, N	S&2Q	1, 2, uranium	Quarterly monitor significant contaminants found in initial sampling; measure static water levels during sample collection
	II	TBD/N	-	TBD	Based on Phase I results
Area C					
19	I	3/S, E	2Q	1a, 6a	Wells DM19-1, DM19-2, and DM19-3
23	I	2/S, N	2Q	1, 3, 2, 5, 7, 8	Locate west and south of landfill; conduct aquifer tests and measure static water levels for 1 yr
		2/S, E	2Q	1, 2, 3, 5, 7, 8	
	II	TBD/N	-	TBD	Based on Phase I results
25	I	5/S, N	2Q	1a-1c, 2, 3, 5, 7	Three between landfill and PTA boundary and two northeast of landfill
		3/C[e], E	2Q	1a-1c, 2, 3, 5, 7	At PTA southwest boundary
		10/S, E	2Q	1a-1c, 2, 3, 5, 7	Conduct aquifer tests on wells DM25-5, DM25-3, and LF-1; measure static water levels for 1 yr
	II	TBD/N	-	TBD	Based on Phase I results
163	II	TBD/N	-	TBD	Based on Phase I results
180	II	TBD/N	2Q	TBD	Coordinate with new wells for Site 34 and existing wells at Site 19
Area D					
21/37	I	33/S, E	2Q	1a, 1c, Rn-220, Rn-222	Monitor all wells installed by USGS
118	II	1+/S, N	2Q	TBD	Shallow wells between pond and brook; based on Phase I results

TABLE 5.5 (Cont'd)

Area and Site	Phase	No. of Wells/ Type[b]	Fre- quency[c]	Analytic Categories[d]	Comments
Area E					
28	II	1/C, N	2Q	See closure plan[f]	Between sewage treatment plant and Green Pond Brook
38	II	TBD/N	-	TBD	Based on Phase I results
Area F					
60	II	TBD/N	-	TBD	Based on Phase I results
61	II	TBD/N	-	TBD	Based on Phase I results
104	II	TBD/N	2Q	TBD	Based on Phase I results
	III	TBD/N	-	TBD	Based on Phase I results
138	I	6/S, N	S	1a, 1c, 2, 8	Drive points downgradient from Bldgs. 404, 407, and 408
	II	2/S, N	2Q	1a, 1c, 2, 8	Shallow wells downgradient from Site
139	II	TBD/N	-	8	Based on Phase I results
140	II	TBD/N	-	TBD	Based on Phase I results
144	II	2/S, N	2Q	2, 8	Two wells downgradient from Bldgs. 462 and 463; based on Phase I results
145	II	2/S, N	2Q	1c, 2, 8	Two wells between Bldg. 447 and brook; based on Phase I results
Area I					
30	II	2/S, N	-	TBD	One upgradient and one downgradient; based on Phase I results
109	I	3/S, N	S	1c, 2, 5a, 8	Drive points downgradient from Bldg. 445
	II	2/S, N	2Q	1c, 2, 8	Downgradient from Site
	III	TBD/N	-	TBD	Based on Phase I results

TABLE 5.5 (Cont'd)

Area and Site	Phase	No. of Wells/ Type[b]	Fre- quency[c]	Analytic Categories[d]	Comments
Area J					
1	II	2/S, N	2Q	1a-1c, 5, 7, CN	Downgradient from dump area along 250-m elevation contour
	II	1/S, E	2Q	1a-1c, 5, 7, CN	Cove well
2	I	1/S, N	2Q	1a-1e, 2, 3, 5, 7, CN, fluoride	Near Bldg. 3521
	I	3/S, E	2Q	1a-1e, 2, 3, 5, 7, CN, fluoride	Wells L, M, and N
	II	TBD[f]	-	TBD	Based on Phase I results
4	I	2/S, N	2Q	1a-1e, 2, 3, 5, 7, CN, fluoride	One near Bldg. 3618 and one between Bldgs. 3611 and 3612
Area K					
3	I	2/S, N	2Q	1a-1e, 2, 3, 7, CN, fluoride	None
	I	1/S, E	2Q	1a-1e, 2, 3, 7, CN, fluoride	Well O
	II	TBD/N	-	TBD	Based on Phase I results
172	III	TBD/N	2Q	1e	Based on Phase II results
174	I	3/S, N	S	1a-1c, 1e, 2, 3, CN	Drive points downslope from sludge beds
	II	TBD/N	-	TBD	Based on Phase I results
Area L					
5	I	2/S, N	2Q	1a-1c, 2, 5a, 7, 8, fluoride	One near Bldg. 3150 and one near northeast end of Site
	I	3/S, E	2Q	1a-1c, 2, 5a, 7, 8, fluoride	Wells MW-3, DM5-1, and DM5-2

TABLE 5.5 (Cont'd)

Area and Site	Phase	No. of Wells/ Type[b]	Frequency[c]	Analytic Categories[d]	Comments
Area L (Cont'd)					
6	I	3/S, E	2Q	1a, 1c, 2, 8	Conduct aquifer tests on MW-5, DM6-1, and DM6-3; measure static water levels for 1 yr
	II	1/S, N	-	TBD	Needed only if groundwater flow is not in northerly direction
17	I	2/S, E	2Q	1a-1c, 2, 5, 7, NH_3, SO_4	Conduct aquifer tests on wells DM17-1 and DM17-3
	II	TBD/N	-	TBD	Based on water quality, hydrology studies
18	III	TBD/N	-	TBD	Based on Phase I and II results
35	II	TBD/N	-	TBD	Based on Phase I results
36	II	TBD/N	-	TBD	Based on Phase I results
41	II	TBD/N	-	TBD	Based on Phase I results
42	II	TBD/N	-	TBD	Based on Phase I results
167	I	1+[e]	S	2	One sample from each sump in Bldg. 1373
168	I	1+[e]	S	1a, 1c, 2	One sample from each sump in Bldgs. 1400 and 1403
169	I	1+[e]	S	1a, 1c, 2	One sample from each sump or catch basin in Bldgs. 1408, 1408A-C, 1409, and 1411
176	II	TBD/N	S	TBD	Based on Phase I results
Area N					
10	I	3/S, E	2Q	1a-1e, 2, 3, 4, 5, 7, 8, CN, fluoride, fluoroacetate	Wells MW-2, DM10-1, and DM10-2

TABLE 5.5 (Cont'd)

Area and Site	Phase	No. of Wells/ Type[b]	Fre- quency[c]	Analytic Categories[d]	Comments
Area N (Cont'd)					
13	I	1/S, N	2Q	1b, 1c, 2, 3, 5, 7, 8	Locate northwest of swamp
	II	TBD/N	-	TBD	Based on Phase I results
Area P					
27	I	1/S, E	2Q	7, cyanide	Well DM27-1
120	II	TBD/N	-	8	Based on Phase I results
121	II	TBD/N	-	TBD	Based on Phase I results

[a]Table lists only those Sites for which groundwater monitoring is specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]S = single well, C = cluster, MP = minipiezometers, N = new well, E = existing well.

[c]S = single sample, 2Q = quarterly monitoring for two quarters followed by review of results.

[d]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives, 3 = gross alpha and beta; 4 = herbicides; 5 = nitrite and nitrate; 5a = nitrate; 6 = TCLP leachability; 6a = TCLP metals; 7 = macroparameters; and 8 = propellants. Other abbreviations are CN = cyanide, NH_3 = ammonia, SO_4 = sulfate, and TBD = to be determined.

[e]Sump water; no wells will be installed.

[f]Analytes for well cluster are those given in the Site 22 closure plan.

TABLE 5.6 Summary of Air Sampling Needs for All Sites at Picatinny Arsenal[a]

Area and Site	Phase	Number of Samples	Analytic Categories[b]	Comments
Area E				
44	I	at least 3	1a-1d, 4, asbestos	Around building
Area J				
2	II	TBD	TBD	Based on Phase I surface soil results
Area K				
3	I	at least 2	1a, 1c, 2	Behind Bldg. 1505 during summer and fall and after testing of solid-fuel engines
Area N				
8	I	at least 4	1a, 1c, 2	One location near sand bunker, another near sand piles during summer and fall
11	I	at least 4	1a, 1c, 2, 8	One location near Bldg. 647 firing area and one near Bldg. 650 during summer and fall
	II	TBD		Based on Phase I results
14	I	at least 4	1a, 1c, 2, 8	One location near sand bunker (Bldg. 638) and one near firing area during summer and fall

[a]Table lists only those Sites for which air sampling is proposed.

[b]The categories are as follows: 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 2 = explosives, 3 = gross alpha and beta, 4 = herbicides, 5a = nitrate, and 8 = propellants.

TABLE 5.7 Summary of Field Inspections Needed for All Sites at Picatinny Arsenal[a]

Area and Site	Description of Inspection
Area C	
23	Locate drums near Site and outside PTA boundary
180	Locate disposal areas and signs of contamination
Area D	
45	Locate signs of contamination
69	Locate drains, signs of contamination, and migration pathways
86	Locate drains, signs of contamination, and migration pathways
117	Locate drains, signs of contamination, and migration pathways
118	Locate signs of contamination
122	Locate drains, signs of contamination, and migration pathways
123	Locate drains, signs of contamination, and migration pathways
182	Locate soil staining or other signs of contamination
183	Locate signs of contamination
Area F	
60	Locate signs of contamination or soil staining
61	Locate signs of contamination or soil staining
104	Locate propellant dumping areas and lime pit; inspect the swamp, creek, and building interiors for signs of contamination
106	Locate signs of contamination and transformer storage area at former location of Bldg. 1010
111	Locate drain outfalls and signs of contamination
124	Locate drains, signs of contamination, and migration pathways
125	Locate drains, signs of contamination, and migration pathways
126	Locate drains, signs of contamination, and migration pathways
138	Locate drains, drain outfalls, and signs of contamination
139	Locate reported decontamination pits and slurry pipeline and locate signs of contamination
140	Locate signs of contamination

TABLE 5.7 (Cont'd)

Area and Site	Description of Inspection
Area F (Cont'd)	
141	Locate signs of contamination
142	Locate signs of contamination
143	Locate signs of contamination
144	Locate drains, drain outfalls, and signs of contamination; inspect any waste cans for leaks
145	Locate sand filters, signs of contamination, and areas of reported waste dumping
146	Locate signs of contamination
Area G	
31	Locate signs of contamination around Bldgs. 314B-314E
96	Locate drains, signs of contamination, and migration pathways
101	Locate drains, signs of contamination, and migration pathways; also look for evidence of disposal activities around Bldg. 311
134	Locate drains, signs of contamination, and migration pathways; look for evidence of disposal activities
135	Locate drains, signs of contamination, and migration pathways
136	Locate drains, signs of contamination, and migration pathways
Area H	
62	Locate drains, signs of contamination, and migration pathways
64	Locate drains, signs of contamination, and migration pathways
98	Locate drains, signs of contamination, and migration pathways
100	Locate signs of contamination and past disposal
127	Locate drains, signs of contamination, and migration pathways
128	Locate drains, signs of contamination, and migration pathways
129	Locate drains, signs of contamination, and migration pathways
130	Locate drains, signs of contamination, and migration pathways
131	Locate drains, signs of contamination, and migration pathways

TABLE 5.7 (Cont'd)

Area and Site	Description of Inspection
Area H (Cont'd)	
132	Locate drains, signs of contamination, and migration pathways
151	Locate signs of contamination around Bldg. 600
Area I	
40	Look for reported pit between Bldgs. 809 and 810
47	Locate signs of contamination
50	Locate signs of contamination; note sumps and weir locations
63	Locate signs of contamination at and near waste oil storage pad
65	Locate signs of contamination at and near waste oil storage pad
70	Inspect areas around buildings and near acid pit and sewage lift station at Bldg. 3028
71	Locate soil staining and spill or waste disposal areas around Bldg. 910
79	Locate soil staining around Bldg. 3013
82	Locate original outflow line and outfall point for silver recovery plant
83	Locate signs of soil and surface contamination around Bldg. 3022
90	Locate drains, signs of contamination, and migration pathways
93	Locate reported pits behind Bldg. 800 and locate reported powder disposal area behind Bldg. 807
97	Locate soil staining and other signs of contamination
102	Locate car rack and areas of oil dumping, soil staining, or inhibited vegetative growth
105	Locate signs of contamination at former location of Bldg. 511
108	Locate areas of reported freon dumping and possible flare activity
109	Locate signs of contamination
110	Locate propellant sticks, if any, near narrow-gauge railroad bed
113	Locate signs of contamination at former location of Bldg. 561
137	Locate drains, signs of contamination, and migration pathways
147	Determine former location of Bldg. 502; locate route of the guncotton line through area

TABLE 5.7 (Cont'd)

Area and Site	Description of Inspection
Area I (Cont'd)	
148	Locate soil staining and other signs of contamination
149	Determine former location of Bldg. 541; locate signs of contamination
150	Locate signs of contamination around Bldg. 555
156	Locate soil staining and other signs of contamination
178	Locate soil staining and other signs of contamination at former locations of Bldgs. 541, 561, 323A, and 1052
184	Locate soil staining and other signs of contamination around Bldg. 523
Area J	
1	Locate all current and preexisting structures, pads, and areas of soil staining and disturbance
2	Locate UXO and other metal debris
4	Locate UXO and other metal debris
175	Locate signs of contamination
Area K	
3	Locate UXO and other metal debris; closely examine forested and other uncleared areas
172	Locate signs of oil staining in parking area and its perimeter
173	Locate soil staining and other signs of contamination around Bldg. 3404
174	Locate boundaries of sludge holding beds and locate drain outfall in swamp
Area L	
35	Inspect Site and areas under tanks to locate catch basin, water pool, and signs of contamination
36	Locate signs of contamination around the loading platform and parking lot; note ditch and drain outfall locations
41	Locate signs of contamination; note ditch and drain outfall locations
42	Locate signs of contamination; note ditch and drain outfall locations

TABLE 5.7 (Cont'd)

Area and Site	Description of Inspection
Area L (Cont'd)	
77	Locate soil staining and spill or waste disposal areas around Bldg. 3150, especially near machine shop and basement storage entrance
91	Locate the reported lead azide washout area near Bldg. 1301
114	Locate soil staining and other signs of contamination
160	Locate soil staining and other signs of contamination around Bldg. 1031
162	Locate soil staining and other signs of contamination around Bldgs. 1070, 1071, and 1071C
166	Locate soil staining and other signs of contamination around Bldgs. 1354, 1357, and 1359
167	Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls
168	Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls
169	Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls
170	Locate soil staining and other signs of contamination around Bldgs. 1462-1465
171	Locate soil staining and other signs of contamination around Bldgs. 3106, 3109, and 3111
Area M	
152	Locate signs of contamination around Bldgs. 604 and 604C
153	Locate signs of contamination around Bldg. 606
154	Locate signs of contamination around Bldgs. 617 and 617G
155	Locate soil staining and other signs of contamination around Bldgs. 620 and 620B
Area N	
7	Inspect firing area and two impact areas to locate signs of contamination
8	Locate UXO, metal debris, and disturbed or stained areas
9	Locate UXO, metal debris, and disturbed or stained areas
11	Locate areas of soil staining or disturbance

TABLE 5.7 (Cont'd)

Area and Site	Description of Inspection
Area N (Cont'd)	
12	Locate areas of soil staining or disturbance
13	Locate waste pit, UXO, metal debris, and areas of disturbance or staining
14	Locate waste pit, UXO, metal debris, and areas of disturbance or staining
Area O	
164	Locate soil staining and other signs of contamination around Bldg. 1217
Area P	
78	Locate drains, signs of contamination, and migration pathways
119	Locate signs of contamination
120	Locate signs of contamination and areas where propellant containers were opened
121	Locate signs of contamination

[a]Table lists only those Sites for which field inspections are needed.

TABLE 5.8 Summary of Geophysical Surveys Needed for All Sites at Picatinny Arsenal[a]

Area and Site	Description of Survey
Area A	
34	Locate buried shells and contaminated areas
Area C	
163	Locate disposal pits and dredge dump areas
180	Locate disposal area
Area F	
104	Locate lime pit if it cannot be located by visual inspection
139	Locate reported decontamination pits and slurry pipeline if they cannot be located by visual inspection
Area G	
101	Locate disposal pits
134	Locate disposal pit
Area I	
53	Locate UXO, containers of explosives, and other dangerous items and debris on bottom of Picatinny Lake and Lake Denmark; use underwater television cameras as necessary
82	Locate original outflow line and outfall point for the silver recovery plant if they cannot be located by visual inspection
83	Locate acid pits and drain lines if they cannot be located by visual inspection
93	Locate reported pits behind Bldg. 800 and reported powder disposal area behind Bldg. 807 if they cannot be located by visual inspection
137	Locate disposal pit
147	Locate disposal pits if they cannot be located by visual inspection or use of old maps
159	Locate disturbed soil and buried metal behind Bldg. 975
178	Locate drain lines at each of four TECUP building locations (Phase II only)
Area J	
1	Locate buried UXO, metal debris, and large area of reported dumping
2	Locate UXO, other metal debris, and USTs, especially former tank farm
4	Locate reported buried propellant containers, UXO, and other items

TABLE 5.8 (Cont'd)

Area and Site	Description of Survey
Area K	
3	Locate UXO, other metal debris, and USTs
Area L	
5	Determine areal extent of buried munitions
18	Locate tetryl pit(s) and survey open area between Bldgs. 1029 and 1038
35	Locate underground pipe and potentially contaminated areas
91	Locate reported lead azide washout area near Bldg. 1301 if it cannot be located by visual inspection
103	Locate UXO on bottom of reservoir; use underwater television cameras
162	Locate reported explosives wastewater leach field near Bldg. 1071; locate Bldg. 1070
167-169	Locate any drain lines leading from building sumps to drain outfalls if they cannot be located by visual inspection
176	Conduct EM survey to locate pits and areas reportedly covered with dredged materials
Area N	
7-9	Locate buried objects and UXO
10	Locate waste disposal pit
11	Locate buried objects, UXO, and areas of soil disturbance
12	Locate buried objects, UXO, and areas of soil disturbance
13	Locate UXO, metal debris, areas of soil disturbance, and waste pit
14	Locate UXO, metal debris, areas of soil disturbance, and waste pit
Area O	
54	Locate UXO, containers of explosives, and other dangerous items and debris on bottom of Picatinny Lake and Lake Denmark; use underwater television cameras as necessary

[a]Table lists only those Sites for which geophysical surveys are needed.

TABLE 5.9 Summary of Drum and Tank Integrity Testing and Sampling Needed for All Sites at Picatinny Arsenal[a]

Area and Site	Description of Testing or Sampling
Area C	
23	Sample contents of drums located during field inspection
Area E	
38	Collect one grab sample each from tanks T-3 through T-6, T-8, and T-9
44	Inspect USTs for leaks
Area J	
2	Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity
4	Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity
175	Sample contents of drums and remove any leaking drums
Area K	
3	Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity
Area L	
35	Sample and remove two tanks near Bldg. 1363A
Area N	
7-9	Sample contents of drums located during field inspection or geophysical survey
10	Sample contents of drums located during geophysical survey
11-14	Sample contents of drums located during field inspection or geophysical survey

[a]Table lists only those Sites for which tank sampling or testing is needed.

TABLE 5.10 Summary of Other Types of Phase I Surveys and Measurements Needed for All Sites at Picatinny Arsenal[a]

Area and Site	Type of Survey or Measurement	Comments
Area A		
34	Continuous core soil samples	Determine particle size distribution, porosity, and hydraulic conductivity
Area C		
23	Aquifer slug test	Test new wells and wells DM23-1 and DM23-2
25	Gradient study	Determine if glacial aquifers are connected to Quaternary aquifer
	Aquifer slug test	Test wells MW-16, DM25-3, and LF-1
Area E		
28	Check of units	Look for subsurface leaks at plant units
	Sampling	Collect and analyze sewage and sludge samples to determine if industrial wastes are present
Area H		
100	Review of DEH records	Determine location of former building, loading dock, and doors
129	Interviews and records search	Establish use of Bldg. 240
Area I		
16	Dye trace test	Locate unknown part of guncotton line; test integrity of line
53	UXO marking and removal	Mark or remove located UXO
Area K		
172	Sampling	Collect two chips from each stained area of asphalt
174	Sampling	Collect two sludge samples from each holding bed
Area L		
18	Soil gas survey	Survey open area between Bldgs. 1029 and 1038
43	Sampling	Collect two chip samples from centers of each of two pads outside Bldg. 3157
103	UXO marking and removal	Mark or remove any located UXO
170	Records search	Locate wastewater discharges, if any

TABLE 5.10 (Cont'd)

Area and Site	Type of Survey or Measurement	Comments
Area M		
15	Sampling	Use methods II-7 and II-8 (see EPA 1987a) to sample sand piles; analyze for explosives, propellants, uranium, and EP toxicity
Area O		
54	UXO marking and removal	Mark or remove located UXO

[a]Table lists only those Sites for which other types of surveys and measurements are needed.

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APPENDIX A:

CHEMICALS USED AT PICATINNY ARSENAL

APPENDIX A:

CHEMICALS USED AT PICATINNY ARSENAL

Tables A.1-A.10 in this appendix list some chemicals that are in use or have been used in the past at Picatinny Arsenal. Some of the tables list inventories of chemicals. The listings are by no means exhaustive and are only meant to give indications of the extent of different types of chemicals used and the variety of activities occurring at PTA. Many chemicals that are used or have been widely used at PTA are not listed in this appendix. These chemicals include some halogenated organic solvents, petroleum products and components, explosives, mineral acids and bases, and other common chemicals.

TABLE A.1 Some Chemicals and Waste Products in Hazardous Waste Listed in the RCRA Parts A and B Permit Applications as of November 8, 1985

Chemical or Waste Product[a]	Estimated Annual Quantity (lb/yr)[b]	EPA Hazardous Waste Number
OB/OD explosives, sludge	1,000	K044
OB/OD spent carbon from explosives	500	K045
Pink-red water	250 ton	K047
4-Aminopyridine	2	P008
Ammonium picrate (R)	5	P009
Barium cyanide	1	P013
Benzenethiol	1	P014
Calcium cyanide	15	P021
Carbon bisulfide	10	P022
Chloroacetaldehyde	1	P023
Copper cyanide	80	P029
Cyanide NOS	100	P030
2,4-Dinitrophenol	5	P048
Ethylenimine	25	P054
Acetic acid	1	P058
Nitric oxide	2	P076
p-Nitroaniline	5	P077
Nitrogen dioxide	2	P078
Nitroglycerin (R)	100	P081
Phosgene	2	P095
Potassium cyanide	100	P098
Potassium silver cyanide	1	P099
Sodium azide	1	P105
Sodium cyanide	80	P106
Strontium sulfide	1	P107
Tetraethyl lead	1	P110
Tetranitromethane	2	P112
Vanadic acid	2	P119
Vanadium pentoxide	2	P120
Zinc cyanide	100	P121

TABLE A.1 (Cont'd)

Chemical or Waste Product[a]	Estimated Annual Quantity (lb/yr)[b]	EPA Hazardous Waste Number
Acetone	1,100	U002
Acetonitrile (I,T)	2	U003
Acetophenone	2	U004
Acetyl chloride (C,R,T)	4	U006
Acrylamide	2	U007
Acrylic acid	4	U008
Aniline (I,T)	4	U012
1,2-Benzanthracene	0.5	U018
Benzene (I,T)	100	U019
Benzidine	0.25	U021
1-Butanol (I)	5	U031
Calcium chromate	100	U032
Chlordane	5	U036
Chlorobenzene	5	U037
Chloroform	100	U044
Creosote	1	U051
Cresols/cresylic acid	1	U052
Crontonaldehyde	3	U053
Cumene (I)	5	U055
Cyclohexane	5	U056
Cyclohexanone	5	U057
DDT	1	U061
Methylene bromide	5	U068
Dibutyl phthalate	10	U069
o-Dichlorobenzene	5	U070
m-Dichlorobenzene	5	U071
p-Dichlorobenzene	5	U072
Dichlorodifluoromethane	5	U075
1,2-Dichloroethane	5	U077
1,1-Dichloroethylene	5	U078
1,2-Dichloroethylene	5	U079
Methylene chloride	5	U080
Diethyl phthalate	10	U088
3,3-Dimethoxybenzidine	1.1	U091
Dimethylamine (I)	1	U092
Dimethylaminoazobenzene	1	U093
1,1-Dimethylhydrazine	1	U098
1,2-Dimethylhydrazine	1	U099
2,4-Dimethylphenol	1	U101
Dimethyl phthalate	10	U102
Sulphuric acid	1	U103
Aniline	1	U104
2,4-Dinitrotolune	5	U105
2,6-Dinitrotolune	5	U106
Di-n-octyl phthalate	10	U107
Ethylacetate (I)	10	U112
Ethylene oxide (I,T)	1	U115
Ethyl ether (I)	10	U117
Formaldehyde	5	U122
Formic acid	1	U123

TABLE A.1 (Cont'd)

Chemical or Waste Product[a]	Estimated Annual Quantity (lb/yr)[b]	EPA Hazardous Waste Number
Furfural (I)	5	U125
Hexachlorobenzene	2	U127
Hexachlorobutadiene	1	U128
Hexachlorocyclopentadiene	1	U130
Hexachloroethane	1	U131
Hydrazine (R,T)	2	U133
Hydrofluoric acid/hydrogen fluoride	10	U134
Hydrogen sulfide	2	U135
Lead acetate	1	U144
Maleic anhydride	1	U147
Mercury	200	U151
Methanol (I)	10	U154
4,4'-Methylene-bis(2-chloroaniline)	5	U158
Methyl ethyl ketone (I,T)	1,100	U159
Methyl ethyl ketone peroxide (R,T)	10	U160
Methyl isobutyl ketone (I)	5	U161
Methyl methacrylate (I,T)	2	U162
Naphthalene	1	U165
1,4-Napthaquinone	1	U166
Alpha/1-Napthylamine	1	U167
Nitrobenzene (I,T)	1	U169
p-Nitrophenol	1	U170
5-Nitro-o-toluidine	1	U181
Pentachloroethane	1	U184
Phenol	3	U188
Phthalic anhydride	1	U190
2-Picoline	1	U191
Pyridine	1	U196
1,4-Cyclohexadienedione	1	U197
Resorcinol	1	U201
Selenious acid; selenium dioxide	1	U204
1,2,4,5-Tetrachlorobenzene	1	U207
1,1,1,2-Tetrachloroethane	1	U208
1,1,2,2-Tetrachloroethane	1	U209
Tetrachloroethane	1	U210
Carbon tetrachloride	1	U211
Tetrahydrofuran (I)	10	U213
Thioacetamide	1	U218
Thiourea	1	U219
Toluene	1,100	U220
1,1,1-Trichloroethane	1	U226
1,1,2-Trichloroethane	1	U227
Trichloroethylene	1,100	U228
Carbamic acid	1,100	U238
Xylene (I)	10	U239
Pentachlorophenol	1	U242
Auto/truck crankcase oil	16,000	X721
Waste oils and bottom sludge cleaning of gas station tanks	500	X723

TABLE A.1 (Cont'd)

Chemical or Waste Product[a]	Estimated Annual Quantity (lb/yr)[b]	EPA Hazardous Waste Number
Waste lube oils	100	X726
Waste oils from transformers	30,000	X727
Clean-up residue B-31	49,000	X725
o-Anisidine	1	D001
N,N-di-n-Butyl acetamide	1	D001
N,N-Diphenyl ethylenediamide	1	D001
Soquinoline[c]	1	D001
Isobutyl alcohol	45	D001
N-N-Dimethyl-formide dimethylacetate	1	D001
N,N-Diethyl-1,3-propane diamine	1	D001
N,N-Diisopropyl ethylene diamine	1	D001
Methyl pyrolidone	1	D001
Diisopropanoline	1	D001
Pyrrolidine	1	D001

[a]Some substances are listed with their hazardous characteristic(s): R = reactive, I = ignitable, C = corrosive, and T = toxic.

[b]Except for pink-red water.

[c]It is assumed that this compound is isoquinoline.

Source: Gaven 1986, Attachment A.

TABLE A.2 Constituents of Hazardous Wastes that May Be Stored in Building 1094

Waste Group	Group Name	Constituents	Hazard Class
1	Nonoxidizing mineral acids	Hydrochloric acid	Corrosive
		Hydrofluoric acid	Corrosive, toxic
2	Oxidizing mineral acids	Chromic acid	Corrosive
		Nitric acid	Corrosive
		Sulfuric acid	Corrosive
3	Organic acids	Acetic acid	Corrosive
		Benzoic acid	Corrosive
		Oxalic acid	Corrosive
4	Alcohols and glycols	1-Butanol	Ignitable
		n-Butyl alcohol	Ignitable
		Glycerine	-
		Methanol	Ignitable, toxic
5	Aldehydes	Crotonaldehyde	Toxic
		Formaldehyde	Toxic
		Furfural	Toxic
7	Aliphatic and aromatic amines	Aniline	Ignitable, toxic
		Benzidine	Toxic
		Diethylenetriamine	-
		Dimethylamine	Ignitable
		p-Dimethylamine azobenzene	Toxic
		Pyridine	Toxic
		Triethylenetetramine	-
8	Azo and diazo compounds and hydrazines	p-Dimethylamine azobenzene	Toxic
		1,1-Dimethylhydrazine	Toxic
		1,2-Dimethylhydrazine	Toxic
		Hydrazine	Reactive, toxic
10	Caustics	Ammonium hydroxide	Corrosive
		Sodium hydroxide	Corrosive
11	Cyanides	Cyanide	Toxic
		Potassium cyanide	Toxic
		Sodium cyanide	Toxic
		Zinc cyanide	Toxic
13	Esters	Di-n-butyl phthalate	Toxic
		Diethyl phthalate	Toxic
		Dimethyl phthalate	Toxic
		Ethyl acetate	Toxic
		Methyl methacrylate	Reactive, toxic
16	Aromatic hydrocarbons	Benzene	Ignitable, toxic
		Cumene	Ignitable
		Naphthalene	Toxic
		Toluene	Toxic

TABLE A.2 (Cont'd)

Waste Group	Group Name	Constituents	Hazard Class
17	Halogenated organics	Acetyl chloride	Corrosive, reactive, toxic
		Carbon tetrachloride	Toxic
		Chlordane	Toxic
		Chloroform	Toxic
		Dibromomethane	Toxic
		1,2-Dichlorobenzene	Toxic
		1,3-Dichlorobenzene	Toxic
		Dichlorodifluoromethane	Toxic
		1,2-Dichloroethane	Toxic
		1,2-Dichloroethylene	Toxic
		1,2-trans-Dichloroethylene	Toxic
		DDT	Toxic
		Hexachlorobenzene	Toxic
		Methylene chloride	Toxic
		Pentachlorophenol	Toxic
		1,1,1,2-Tetrachloroethane	Toxic
		1,1,2,2-Tetrachloroethane	Toxic
		Tetrachloroethylene	Toxic
		Tetrachloromethane	Toxic
		1,1,1-Trichloroethane	Toxic
		1,1,2-Trichloroethane	Toxic
		Trichloroethylene	Toxic
19	Ketones	Acetone	Ignitable
		Acetophenone	Ignitable
		Cyclohexane	Ignitable
		Methyl ethyl ketone	Ignitable, toxic
		Methyl isobutyl ketone	Ignitable
		Quinones	Toxic
20	Organic sulfides	Carbon disulfide	Acutely toxic
		Polysulfide	a
21	Elemental, alkaline, and alkali-earth metals	Magnesium	Reactive
		Potassium metal	a
		Sodium metal	Reactive
24	Toxic metals and metal compounds	Barium chloride	a
		Chromic acid	Toxic, corrosive, reactive
		Lead acetate	Toxic
		Mercuric chloride	a
		Mercuric iodide	a
		Mercuric nitrate	a
		Mercurous nitrate	a
		Mercury	Toxic
		Potassium dichromate	a
		Selenious acid	Toxic
		Stannic chloride	a

TABLE A.2 (Cont'd)

Waste Group	Group Name	Constituents	Hazard Class
24 (cont'd)		Tetraethyl lead	Acutely toxic
		Vanadic acid	Acutely toxic
		Vanadium pentoxide	Acutely toxic
		Zinc chloride	a
		Zinc cyanide	Acutely toxic
		Zinc sulfate	a
26	Nitriles	Acetonitrile	Ignitable, toxic
27	Nitro compounds	2,4-Dinitrophenol	Toxic
		Nitrobenzene	Ignitable, toxic
		4-Nitrophenol	Toxic
		Tetranitromethane	Acutely toxic
29	Saturated aliphatics	Cyclohexane	Ignitable
30	Organic peroxides	Benzoyl peroxide	Reactive
31	Phenols and cresols	Creosote	Toxic
		Cresol	Toxic
		2,4-Dimethylphenol	Toxic
		2,4-Dinitrophenol	Toxic
		4-Nitrophenol	Toxic
		Pentachlorophenol	Toxic
		Phenol	Toxic
		Pyrogallol	a
		Resorcinol	Toxic
101	Combustibles and flammables	Polysulfide	a
102	Reactants	Benzoyl peroxide	Reactive
		Tetranitromethane	Reactive
103	Polymerizable compounds	Acrylic acid	Ignitable
		Ethylene oxide	Ignitable, toxic
		Methyl methacrylate	Ignitable, toxic
104	Strong oxidizing agents	Bromine	a
		Chromic acid	Toxic
		Mercuric nitrate	a
		Mercurous nitrate	a
		Potassium dichromate	a

TABLE A.2 (Cont'd)

Waste Group	Group Name	Constituents	Hazard Class
105	Strong reducing	Acetyl chloride	Corrosive, reactive, toxic
		Magnesium	Reactive
		Phosphorus pentoxide	a
		Red phosphorus, amorphous	a
		Sodium metal	Reactive
		Stannic chloride	a
		Sulfuric acid	Corrosive

[a]Wastes that do not meet hazard criteria or for which no information is available.

Source: Foster Wheeler 1987a.

TABLE A.3 Types and Amounts of Pesticides, Dyes, Soil Conditioners, and Micronutrients Stored in Buildings 39 and 41

Material	Amount	Material	Amount
Fungicides			
Subdue	4 cans + 2.5 gal	Clearys 3336 F	5 gal
Banol	2 cans + 4 qt	Alliette	4 2-lb boxes
Bayleton	7 cans	Koban 30	2 lb
Daconil 2787	10 cans + 1 gal	Acti Dione RZ	10 lb
Rubigan	5.5 cans	Banner F	4 cans + 2 gal
Acti Dione TGF	5 cans	Chipco 26019	8 cans
Spotrete F	8 cans	Tersan 1991	8 cans
Spotrete WP	17 cans + 3 lb	Caddy	10 gal
Dyrene 4	20 cans + 2.5 gal	P.M.A.S.	9.5 gal
Manzate 200F	7 cans + 1 gal		
Insecticides			
Carbaryl 4L	7 cans	Proxol 80SP	1 can
Diazinon	2 gal	Dursban	11 gal
Oftanol F	3 gal	Turcam	6 cans
Herbicides			
Weed-E-Rad (DSMA)	2 cans + 5 gal	Tupersan	16 lb
Acclaim	1 gal	Round Up	4 gal
Trimec-(Broad)	4 cans + 1 gal	Treflan G	3 40-lb bags
Trimec (Bent)	5 cans + 4 gal	Eptam G	2 25-lb bags
Betasan-4 EC	28 gal	Banvel	2.5 gal
Formula A	5 gal	MCPP-2,4-D	1 gal
Soil Conditioners			
Pen Turf	16 cans	Aqua Gro F	2 gal
Aqua Gro G	30 drums	Vapor Guard	3 gal
Micronutrients			
Agri Plex	4 cans	Micro-Green Liquid	1 can
Dyes			
Blazon	4 cans	Dyon	6 cans
Tru Green	0.5 gal		

Source: Clune and Milio 1988.

TABLE A.4 1979 Inventory of Pesticides in Building 39

Name	Active Ingredient	Quantity
Acti-dione Thiram	Cycloheximide 0.75%, thiram 75%	3 lb
Banvel 4-S	Dicamba 49%	5 gal
Caddy	Cadmium chloride 20.1%	21 gal
CALO-CLOR	Mercury chlorides 90%	25 lb
Chloro-40% W	Chlordane 40%	4 lb
Chlordane 72% EC	Chlordane 72%	10 gal
Cleary's 3336	Thiophanate 50%	2 lb
Corrosive sublimate	Mercuric chloride 99.5%	25 lb
Daconil 2787	Chlorothalonil 75%	18 lb
Diazinon AG-48	Diazinon 48%	6 gal
Dursban 2E	Dursban 22.5%	10 gal
Dyrene	Anilazine 50%	5 lb
Formula 40	2,4-D 38.5%	10 gal
Greg Turf	Copper 9.9%, cadmium 4.2%, zinc 4.1%, chromium 3.2%	25 lb
MCPP	2-(4-chloro-2-methylphenoxy) propionic acid 25.9%	5 gal
Mather 30	Disodium methanearsonate 18.9%	10 gal
Mather 80	Disodium methanearsonate 80%	150 lb
PMAS	Phenyl mercuric acetate 10%	90 gal
Proxol SP	Dimethyl phosphonate 80%	8 lb
Spotrete F	Thiram 42%	3 gal
Spotrete	Thiram 75%	72 lb
Tersan ON	Hydroxymercurichlorophenols 10%, thiram 45%	9 lb
Tersan SP	Chloroneb 65%	6 lb
Tersan 75	Thiram 75%	6 lb
Tersan 1991	Benomyl 50%	12 lb
Trimec	2,4-D 6.5%, MCPP 19.87%, dicamba 2.63%	5 gal

Source: USAEHA 1979a.

TABLE A.5 1979 Inventory of Pesticides in Building 41

Name	Active Ingredient	Quantity
Acti-dione	Ferrated cycloheximide 2.26%	102 oz
Acti-dione RZ	Pentachloronitrobenzene 75%, cycloheximide 1.3%	50 lb
Acti-dione TGF	Cycloheximide 2.1%	450 oz
Acti-dione Thiram	Cycloheximide 0.75%, thiram 75%	1,410 lb
Aquathole	Silvex 5.6%, endothall 5.1%	500 lb
Auragreen	Basic copper carbonate 50%	5 lb
Balan	Benefin 2.5%	9,200 lb
Cadmium chloride	Cadmium chloride 20.1%	50 gal
Captan	Captan 50%	335 lb
Cleary's 3336	Thiophanate 50%	84 lb
Crabgrass preventer	Dimethyl ester of tetrachloro-terephthalic acid 4.7%	60 lb
Crown WP sulfur 95%	Sulfur 95%	900 lb
Daconil	Chlorothalonil 40.4%	58 gal
Daconil	Chlorothalonil 54%	10 gal
Daconil	Chlorothalonil 75%	24 lb
Dicot Weed Control II	2,4-D 1.15%, propinic acid 1.15%	3,470 lb
DSB	Benomyl 1.5%	840 lb
Fore	Manganese ethylene bisedithio-carbamate 80%	48 lb
Granular copperas	Ferrous sulfate	300 lb
Koban30	5-Ethoxy-3-trichloro-methyl-1-1,2,4-thiodiazole 30%	128 lb
Koban	5-Ethoxy-3-trichloro-methyl-1-1,2,4-thiodiazole 35%	90 lb
K-O-G	Dicamba 70%	1,775 lb
Proturf	Chloroneb 6.5%	1,277 lb
Proxol 80 SP	Richlofon 80%	72 lb
SLO-GRO	6-Hydroxy-3-(2H)-pyridazinone, diethylanolamine salt 58%	90 gal
Spotrete	Thiram 75%	432 lb
Spotrete-F	Thiram 42%	84 gal
Tersan LSR	Maneb 80%	99 lb
Tersan 1991	Benomyl 50%	180 lb
Tersan OM	Hydroxymercurichlorophenols 10%, thiram 45%	18 lb
Tersan SP	Chloroneb 65%	324 lb
Tersan75	Thiram 75%	144 lb
TPO	Thiram 5%, cadmium chloride 0.75%	80 lb
Tupersan	Siduron 50%	20 lb
Aquathol Plus	Potassium salts of endothall 22.1% and silvex 52.6%	25 gal
Aquathol Plus	Potassium salts of endothall 5.1% and silvex 5.6%	600 lb
Captan	Captan	540 lb
Chip-Cal	Tricalcium arsenate 48%	80 lb
Copper-Tox	Copper 3%	1 gal
Dapsodar	Disodium monomethyl arsenate hexahydrate 50%	10 lb
Floral dust	Sulfur 26.2%, methoxychlor 5%, ferric dimethyldithiocarbamate 7.6%, rotenone 0.75%	9 lb
Lead arsenate	Lead arsenate	96 lb

TABLE A.5 (Cont'd)

Name	Active Ingredient	Quantity
Lethane 384	b-Butoxy-b-thiocyanodiethyl ether	55 gal
Lindane-aramite	Lindane 6%	10 gal
Malathion 25% WP	Malathion 25%	50 lb
Malathion 57% EC	Malathion 57%	5 gal
Methar 100	Disodium methanearsonate 63%	50 lb
Methar 80	Disodium methanearsonate 50.4%	50 lb
MH-30	Maleic hydrazide 585	55 gal
Monuron 80% WP	Monuron 80%	100 lb
Nicotine 20%	Nicotine 20%	5 gal
Nicotine 40%	Nicotine 40%	10 gal
Pyrethrins	Pyrethrins	5 gal
Red Arrow garden spray	Pyrethrins 0.5%, rotenone 1.5%	6 gal
Rotenone	Rotenone 1%	100 lb
Samesan	Hydroxymercurichlorophenol 25.3%	50 lb
SLO-GRO	Diethanolamine salt of 6-hydroxy-3-(2H)-pyridazinone 58%	120 gal
Sulfur 95% WP	Sulfur 95%	50 lb
Telvar	Monuron 80%	100 lb
Tepp 40%	Tepp 40%	4 gal
Thiram	Thiram 75%	36 lb
2,4-D	2,4-D in concentrations up to 95%	77 gal + 30 lb
2,4,5-T	2,4,5-T	55 gal
Ureabor	Disodium tetraborate hydrates 93.5%, 2,3,6-trichlorobenzoic acid 0.6%	1,100 lb

Source: USAEHA 1979a.

TABLE A.6 Inventory of Pesticides in Building 3157

Trade Name	Active Ingredient (%)	Quantity
1980 excess pesticides		
Drazinon	Diazinon (47.5%)	10 gal
Diazinon (powder)	Diazinon (2%)	55 lb
Malathion	Malathion (57%)	255 gal
Malathion	Malathion (95%)	35 gal
Abate 4E	Temephos (43%)	1 gal
DDT	DDT (5%)	2.5 gal
Calcium cyanide	Calcium cyanide (42%)	14.5 lb
Ortho additive	-- (80%)	40 gal
June 1988 inventory		
Baygon	Propoxur (2%)	13.5 lb
Sevin	Carbaryl (80%)	38 lb
Pyrethrins	Pyrethrins (1%)	33 lb
Killmaster	Chlorpyrifos (1%)	56 oz
Killmaster	Chlorpyrifos (2%)	24.5 gal
Contrac	Bromadialone (0.005%)	244 lb
Sparrow cracks	Strychnine alkaloid (0.6%)	18 lb
Combat	Hydramethylon (1.65%)	91 baits
Wasp spray	Resmethrin (0.15%)	11 cans
Gencor plus	Hydroprene (0.85%)	48 cans
Precor plus	Methoprene (0.15%)	25 cans
Smokem	Potassium nitrate (46.2%)	48 cartridges
Moth flakes	Naphthalene (100%)	30 lb
Cythion malathion	Malathion (91%)	72 gal
Pyrethrum fogging spray	Pyrethrins (0.1%)	10 gal
Precor	Methoprene (65.7%)	17 mL
Diazinon	Diazinon (47.5%)	1.5 gal
Trimec	2,4-D (42.54%)	11.0 gal
Amine salt MCPP-2,4D	2,4-D (46.35%)	1.5 gal
Round-up	Glyphosate (41%)	19 gal
Diquat	Dibromide (35.3%)	26 gal
Copper sulfate	Pentahydrate (99%)	124 lb
D-Phenothrin	D-Phenothrin (1.92%)	25 cans
Treflan	Trifluralin (--)	70 lb
Abate 4E	Temephos (43%)	1 gal
Baygon	Propoxur (14.6%)	8 gal
Combat ant baits	Hydramethylnon (0.9%)	852 bait trays

Sources: Ludemann et al. 1981; Clune and Milio 1988.

TABLE A.7 Herbicide Use at Picatinny Arsenal in 1973 and 1974

Date Used and Herbicide	Amount of Active Ingredient	Annual Usage
Used in 1973		
Ammate "X"	-	4,250 lb
2,4,5-T	-	19 gal
2,4-D	-	53 gal
Used in 1974		
Hyver[a]	-	310 lb
Dowpon[a]	-	790 lb
2,4-D[a]	-	120 lb
Copper sulfate	-	900 lb
Dacthol, granulated	4.7%	1,000 lb
DSMA 100, powder	63%	125 lb
2,4-D amine, liquid	95.4%, 4 lb/gal	5 gal
Dicamba, liquid	49%, 4 lb/gal	3 gal

[a]Used for soil sterilization.

Source: Rigassio et al. 1975.

TABLE A.8 Other Chemicals at the Picatinny Arsenal

Chemical	Quantity	Reference	Uses
Cadmium cyanide	-	a	Cadmium plating
Zinc cyanide	-	a	Zinc plating
Sulfuric acid	-	a	Anodizing
Chromic acid	-	a	Chrome plating
Polychloronaphthalenes	-	a	Component of risers
Cellulose acetate	-	a	Plastic dipping
Cellulose butyrate	-	a	Plastic dipping
Lead azide	-	a	Component of detonators
Lead sulfocyanate	-	a	Component of detonators
Antimony sulfite	-	a	Component of detonators
Lead stearate	-	a	-
Diethyl phthalate	-	a	-
Triacetin	-	a	-
2-nitrodiphenylamine	-	a	-
Dinitroethylbenzene	-	a	Casting small arms powder
Barium chromate	-	a	Delay powder manufacture
Potassium perchlorate	-	a	Delay powder manufacture
Ether	-	a	Mixing operations
Arsenic trisulfide	-	a	Used in M-12 smoke mixture
Methyl ethyl ketone	-	a	Mixing tracer composition
Hydrogen cyanide	-	b	Metal treatment and plating
Mercury vapor	-	b	Testing of propellants
Hydrazoic acid	-	b	Laboratory research
Butyl glycerol ether	-	b	Potting and mixing resins
4,4'-Methylene-bis(2-chloroaniline)	-	b	Potting electronic parts
Styrene monomer	-	b	Attaching pin extensions
Vinyl methyl ether	2 lb	c	-
Chlorine trifluoride	13 cyl.	c	Propellant
Perchloral fluoride	1 cyl.	c	Propellant
Bromine pentafluoride	2 cyl.	c	Propellant
Halox	7 cyl.	c	Propellant

[a]U.S. Army 1952.

[b]USAEHA 1975a.

[c]Crane 1982.

TABLE A.9 Propellant Components

Acetone
Ammonium dichromate
Ammonium nitrate
Ammonium perchlorate
Ammonium picrate
Asphalt
Bd-MVP copolymer (90% butadiene, 10% 2-methyl-5-vinylpyridine copolymer)
Butyl carbitol adipate
Butyl carbitol formal
Carbon black
Cellulose acetate
Diallyl maleate
Di-n-butyl-phthalate
Dibutyl sebacate
Di-(2-ethylhexyl)acetate
Diethyl phthalate
Diglycol dinitrate
Dinitrophenoxyethanol
Dioctyl phthalate
Diphenylamine
Diphenylguanidine
Ether
Ethyl alcohol
Ethyl centralite
Graphite
GR-I rubber
HMX, Cyclotetramethylene-tetranitramine
Lead stearate
M & V
N-Methyl-p-nitroaniline
Metriol trinitrate
Mineral jelly
Nitrocellulose, 12.2% N
Nitrocellulose, 12.6% N
Nitrocellulose, 13.15% N
2-Nitrodiphenylamine
Nitroglycerin
Nitroguanidine
PETN, Pentaerythritol tetranitrate
Petrin
Polyester
Polyisobutene
Polymethyl acrylate
Polystyrene
Polyurethane
Polyvinyl chloride
Potassium nitrate
Potassium perchlorate
Potassium sulfate
RDX, Cyclotrimethylene-trinitramine
Sucrose octaacetate
Triacetin
Triethylene glycol dinitrate
Trinitrotoluene

Source: USAEHA 1975a.

TABLE A.10 Solventless Rocket Propellant Ingredients

Substance	Function	%
Nitrocellulose	Propellant	49.4
Nitroglycerin	Propellant	35.3
Diethyl phthalate	Plasticizer	10.5
Candelilla wax	Extrusion lubricant	2.0
2-Nitrodiphenylamine	Stabilizer	2.0
Lead 2-ethylhexoate	Burning rate	1.4
Lead salicylate	Burning rate	1.2

Source: USAEHA 1975a.

APPENDIX B:

RADIOACTIVE MATERIALS AT PICATINNY ARSENAL

TABLE B.1 Location and Conditions of Radiation Operations at Picatinny Arsenal[a]

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
6	Tritium watches (exempt items) were examined. Now removed.	H-3, mCi quantity	None. Area was swiped and found clean.
18/Radio-Luminous Light Lab	Work with tritium lamps.	H-3, kCi quantity	None. Area is swiped regularly and kept clean.
19	Former weapons training facility that used DU items. Facility has since been renovated and is used as an inert training area.	U-238, mCi quantity	None. Tested in 1982 and found to be clean.
22	Machining of DU and thorium alloys.	U-238, lb quantity Th-232, lb quantity	Surfaces are clean but there is potential for retention in or below wooden floor.
Boxcar behind Bldg. 22	Change area for DU thorium machining operation in Bldg. 22.	U-238, trace quantity	None. Area was surveyed and found clean.
23	Machining of DU and thorium alloys in the 1950s.	U-238, mCi quantity Th-232, mCi quantity	Minimal. Area checked in 1971 and found clean. Trace quantities could remain in the cracks in the floor, etc.
31	Machining of DU and thorium alloys.	U-238, mCi quantity Th-232, mCi quantity	Surfaces are clean but there is potential for retention in or below wooden floor.
55/D6	Storage facility for incoming shipments.	Mostly U-238 and H-3, occasionally others	None. Rad material not opened here. Area is swiped regularly and kept clean.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
60/Test Area	Environmental testing of military equipment, some of which contained DU, tritium, or thorium.	U-238, mCi quantity H-3, Ci quantity Th-232, trace quantity	All areas known to have been contaminated have been decontaminated.
60/Vault	Used to store radioactive items between tests. Vault was contaminated in 1978 and was decontaminated by RAD SVCS Inc.	U-238, mCi quantity Th-232, trace quantity	None. Area is clean.
64	DU items handled in building. Also thermal batteries and some other sealed sources.	U-238, mCi quantity Pu-238, 8 Ci Pm-147, mCi quantity	No record of contamination. Operations were of type unlikely to cause contamination. Building has since been renovated.
68	Weapons maintenance procedures developed utilizing DU items.	U-238, mCi quantity	None. Area kept clean.
70	Earth-covered magazine previously used to store three tritium gun sights. Now none.	H-3, mCi quantity	None. Area is clean.
84	Weapons maintenance procedures developed utilizing DU items.	U-238, mCi quantity	None. Area kept clean.
91/Cage	Temporary storage of radioactive shipments.	H-3, Ci quantity U-238, mCi quantity	None. Area monitored and kept clean.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
92/Cal. Lab	Thickness gauging using betascope. Calibration using sealed sources.	Various beta emitters, sealed sources Co-60, mCi quantity Sr-90, mCi quantity Am-241, mCi quantity	None. Area was monitored and sources have not leaked.
92/Shock Test Area	Shock testing of DU-containing items.	U-238, mCi quantity	None.
92/Lab Area	Optical comparer measurements of DU cores.	U-238, mCi quantity	None. A noninvasive test.
94	An administrative area in which some sabot rounds were found in 1982. Similar situations may have occurred other times, as well.	U-238, about 50 lb	None. No leakage was found.
95	Gauging of DU items.	U-238, mCi quantity	None. Area has been checked.
95/Rm. 1	Thickness gaging using betascope.	Various beta emitters, sealed sources	None. Area was monitored and sources have not leaked.
167	Radioactive tracers used in chemistry experiments.	H-3, mCi quantity C-14, mCi quantity U-238, mCi quantity Th-232, mCi quantity	Minimal. The lab was decontaminated. The sink had unremovable U-238 contamination in a crack. Presumably some small quantity also went down the drain during the building's lifespan but could not be detected.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
Cage outside 167	Waste storage for Bldg. 167 operations.	C-14 I-129, mCi quantity Ba-133, mCi quantity Pb-210, mCi quantity Th-232, mCi quantity Al-activated, mCi quantity U-238, mCi quantity	No record of problems.
183/ Wegman's Lab.	Surface measurements using meseran test solution.	C-14, µCi quantity	None. All particles detectable by meter were cleaned up.
221	Radiography using Cs-137 sealed source, currently in storage mode.	Co-60, 6.8 Ci (sealed)	None. No leaks.
266	Dew point measurements using radium-containing device.	Ra-266, 6.25 mCi	None. Item is leak tested and does not leak.
307	Electric shop worked on tritium-contaminated motor in 1983.	H-3, insignificant quantities (189 dpm/100 cm^2)	None. Quantities were too small to cause contamination. Area was found clean.
312	Storage area for health physics lab used primarily to hold material waiting for disposal.	U-238, mCi quantity H-3, Ci quantity Co-60, Ci quantity (sealed) Other isotopes in future	None. Area is k ot clean and swiped frequently.
315	Machining, mechanical testing, sample preparation and corrosion testing of DU.	U-218, Ci quantity	Minor. This facility is slightly contaminated but can be easily decontaminated.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
316	Research in high-rate cooling of DU alloys.	U-238, mCi quantity	Minor. This facility is slightly contaminated but can be easily decontaminated.
318	Closed oven with DU contamination inside was found in 1987. Probably from Frankford Arsenal. Exterior of oven was clean. Oven was disposed of.	U-238, trace quantity	None. Area was swiped and found clean.
319	Static meters stored in cabinet.	H-3, mCi quantity	None. No leaks.
320	Health physics lab and storage area.	Alpha, beta, and gamma emitters of many types in sealed sources Solid uranium and thorium compounds, lb quantity Solid uranium metal for ammo. penetrators, up to 200 lb H-3 in sealed vials for luminous light sources, several hundred Ci Low-level waste for disposal	None. Facility is swiped regularly and kept clean.
352	Metallurgical tests (hardness, tensile strength).	U-238, μCi quantity	None. Area was monitored.
355/Rm. 20	Examination of DU metallurgical samples.	U-238, μCi quantity	None. Area kept clean.
355/Rm. 18	Mechanical testing of DU samples.	U-238, mCi quantity	None. Area kept clean.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
355/Rm. 38	Past corrosion testing of DU samples.	U-238, mCi quantity	None. Area kept decontaminated.
355/Other rooms	Electron micrography of DU samples.	U-238, nCi quantity	None. Area kept clean.
407/Rm. 40	Some work with small quantities of tracers.	H-3 and C-14, μCi quantity	None. Area is clean and has since been renovated.
407/Rms. 36 and 42	Storage and use of an explosives detector and a research chromatograph.	Ni-63 sealed sources, mCi quantity	None. No leakage.
514	Radiography using sealed Co-60, Cs-137, and PuBe sources.	Co-60, 12 kCi Cs-137, 250 Ci Pu, unknown quantity (all sealed)	None. Area monitored regularly and no leaks occurred.
604C	Removal of DU cores from DU penetrators by remote control. Ongoing. Some work was done on broken LAW sights.	U-238, mCi quantity Pm-147, mCi quantity in microspheres	None. Area is checked for DU. PM-147 was cleaned up.
611B	Indoor firing range for DU subcaliber penetrators.	U-238, mCi quantity	Interior of facility is contaminated. A fire in the HEPA filter system released a few particles of DU, which were cleaned up.
617C	Removal of DU cores from DU penetrators in 1978. Other similar activities since.	U-238, mCi quantity	None. Area was checked.
620	Powder level gaging using a sealed Cs-137 sealed source.	Cs-137, 2 Ci (sealed)	None. No leaks.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
654/ (Area 3)	Outdoor tests of 2 BLU-63 warheads containing a total of less than 2 lb DU for velocity measurements.	U-238, less than 2 lb	None. All particles detectable by meter were removed. Remainder (too small to detect) was spread over an area of 30,000 ft^2. Air was sampled during test and never exceeded 1.1 E-11 µCi/mL.
908	Development of radiographic devices. Eddy current testing of DU cores.	Co-60, 100 Ci (sealed) Cf-252, 5.4 Ci (sealed) U-238, mCi quantity	None. Sources are leak tested regularly. Eddy current test area was swiped regularly.
1090	Radiographic System under development.	Co-60, 13 kCi	None. No leakage.
1207	A box with one DU-containing item was found in 1982.	U-238, mCi quantity	None. Area was checked and found to be clean.
1462	Used a sealed Ba-133 source.	Ba-133, mCi quantity	None. Source did not leak.
1503 Chamber 7	Conditioning box in which broken M422s (contained DU) were stored.	U-238 , mCi quantity	None. Area was decontaminated.
1505 Area	Used to test M422s. Some broke, releasing pieces of uranium.	U-238, mCi quantity	Possible. Detectable material was picked up and stored in 1503.
3018	Earth-covered magazine used as a radioactive material storage area for the Health Physics Laboratory.	Various isotopes and quantities similar to those listed for Bldgs. 320, 3021, and 3030	None except small quantity of H-3, which remains from the operation, that evaded all decontamination efforts.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
3021/Vault Rm. D	Former Health Physics Lab storage area.	U-238, several hundred lb H-3, several hundred Ci Co-60, several hundred Ci (sealed) Cs-137, multi Ci, (sealed) Ir-192, mCi (sealed) Ra-226, μCi (compasses) Cf-252, mG (sealed) Sr-90 mCi (sealed) Pu-238, 8 Ci in thermal batteries C-14, μCi quantities in small solution vials Other isotopes, μCi quantities in sealed sources	None. Area is clean except for a slightly contaminated hood used to hold leaking H-3 light sources. This hood may be removed.
3021/ Dougherty Box	Irradiation of samples using a sealed Co-60 source.	Co-60, 15 kCi (sealed)	None. No leakage.
3028/ Rms. 124 and 198	Storage of explosives detector and research chromatograph.	Ni-63, 10 mCi (sealed)	None. Leak tested. No leaks found.
3028/ Several rooms	Some thorium and uranium compounds were found stored but not used.	U-238, mCi quantity Th-232, mCi quantity	None. Chemicals were collected and area surveyed and found clean.

TABLE B.1 (Cont'd)

Bldg./Room	Description of Operation	Isotopes and Quantities	Contamination Potential
3030	Current Health Physics Lab storage facility. In the past was used to store a wide variety of isotopes. Currently used for classified storage.	U-238, mCi quantity H-3, Ci quantity in luminous sources Pm-147, mCi quantity in compounds Co-60, Ci quantity Cs-137, Ci quantity C-14, mCi quantity sealed and in tagged compounds Sr-90, mCi quantity Various other isotopes in check sources	None except small quantity of H-3 (200 dpm/100 cm) remaining on the shelves where H-3 light sources were stored.
3109	Environmental testing of military items, some with DU or H-3.	U-238, mCi quantity H-3, Ci quantity	None known.
3114	Once had items containing DU.	U-238, unknown small quantity	None. Checked and found clean.
3208	Use and storage of several static meters containing H-3.	H-3, mCi quantity	None. No leakage.
3337	Storage of a lathe contaminated with DU.	U-238, trace quantity	None. Area was checked.
3338	Storage of an oven with possible interior contamination of DU.	U-238, trace quantity	None. Oven is closed. Exterior is clean.

[a]It is DOD policy not to release information accessible to the public or foreign governments that would tend to confirm or deny the presence of nuclear weapons or their parts or that might otherwise indicate their presence or absence. Under this policy, DOD cannot list the presence or absence of special nuclear material such as plutonium-239, uranium-235, or other similar materials. However, DOD is not aware of any location that contains any significant environmental contamination of special nuclear material and believes that if there were any such locations at Picatinny Arsenal, DOD would be aware of them.

Source: Duncan 1990.

APPENDIX C:

CHEMICAL ANALYSIS CATEGORIES

APPENDIX C:

CHEMICAL ANALYSIS CATEGORIES

TABLE C.1 The Contract Laboratory Program Hazardous Substances (TCL+30 Parameters)

Compound	USATHAMA Test Name	Compound	USATHAMA Test Name
Volatiles		40. 1,4-Dichlorobenzene	14DCLB
		41. Benzyl alcohol	BZALC
1. Chloromethane	CH3CL	42. 1,2-Dichlorobenzene	12DCLB
2. Bromomethane	CH3BR	43. 2-Methylphenol	2MP
3. Vinyl chloride	C2H3CL	44. Bis(2-chloroisopropyl) ether	B2CIPE
4. Chloroethane	C2H5CL	45. 4-methylphenol	4MP
5. Methylene chloride	CH2CL2	46. N-Nitrosodipropylamine	NNDNPA
6. Acetone	ACET	47. Hexachloroethane	CL6ET
7. Carbon disulfide	CS2	48. Nitrobenzene	NB
8. 1,1-Dichloroethene	11DCE	49. Isophorone	ISOPHR
9. 1,1-Dichloroethane	11DCLE	50. 2-Nitrophenol	2NP
10. trans-1,2-Dichloroethylene	T12DCE	51. 2,4-Dimethylphenol	24DMPN
11. Chloroform	CHCL3	52. Benzoic acid	BENZOA
12. 1,2-Dichloroethane	12DCLE	53. Bis(2-chloroethoxy) methane	B2CEXM
13. 2-Butanone	MEK	54. 2,4-Dichlorophenol	24DCLP
14. 1,1,1-Trichloroethane	111TCE	55. 1,2,4-Trichlorobenzene	124TCB
15. Carbon tetrachloride	CCL4	56. Naphthalene	NAP
16. Vinyl acetate	C2AVE	57. 4-Chloroaniline	4CANIL
17. Bromodichloromethane	BRDCLM	58. Hexachlorobutadiene	HCBD
18. 1,1,2,2-Tetrachloroethane	TCLEA	59. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	4CL3C
19. 1,2-Dichloropropane	12DCLP		
20. trans-1,3-Dichloropropene	T13DCP	60. 2-Methylnaphthalene	2MNAP
21. Trichloroethene	TRCLE	61. Hexachlorocyclopentadiene	CL6CP
22. Dibromochloromethane	DBRCLM	62. 2,4,6-Trichlorophenol	246TCP
23. 1,1,2-Trichloroethane	112TCE	63. 2,4,5-Trichlorophenol	245TCP
24. Benzene	C6H6	64. 2-Chloronaphthalene	2CNAP
25. cis-1,3-Dichloropropene	C13DCP	65. 2-Nitroaniline	2NANIL
26. 2-Chloroethylvinyl ether	2CLEVE	66. Dimethyl phthalate	DMP
27. Bromoform	CHBR3	67. Acenaphthylene	ANAPYL
28. 2-Hexanone	MNBK	68. 3-Nitroaniline	3NANIL
29. 4-Methyl-2-pentanone	MIBK	69. Acenaphthene	ANAPNE
30. Tetrachloroethene	TCLEE	70. 2,4-Dinitrophenol	24DNP
31. Toluene	MEC6H5	71. 4-Nitrophenol	4NP
32. Chlorobenzene	CLC6H5	72. Dibenzofuran	DBZFUR
33. Ethylbenzene	ETC6H5	73. 2,4-Dinitrotoluene	24DNT
34. Styrene	STYR	74. 2,6-Dinitrotoluene	26DNT
35. Total xylenes	TXYLEN	75. Diethyl phthalate	DEP
		76. 4-Chlorophenylphenyl ether	4CLPPE
Semivolatiles		77. Fluorene	FLRENE
		78. 4-Nitroaniline	4NANIL
36. Phenol	PHENOL	79. 4,6-Dinitro-2-methylphenol	46DN2C
37. Bis(2-chloroethyl) ether	B2CLEE	80. N-Nitrosodiphenylamine	NNDPA
38. 2-Chlorophenol	2CLP	81. 4-Bromophenylphenyl ether	4BRPPE
39. 1,3-Dichlorobenzene	13DCLB	82. Hexachlorobenzene	CL6BZ

TABLE C.1 (Cont'd)

Compound	USATHAMA Test Name	Compound	USATHAMA Test Name
Semivolatiles (Cont'd)		118. Chlordane	CLDAN
		119. Toxaphene	TXPHEN
83. Pentachlorophenol	PCP	120. Aroclor 1016	PCB016
84. Phenanthrene	PHANTR	121. Aroclor 1221	PCB221
85. Anthracene	ANTRC	122. Aroclor 1232	PCB232
86. Di-n-butyl phthalate	DNBP	123. Aroclor 1242	PCB242
87. Fluoranthene	FANT	124. Aroclor 1248	PCB248
88. Pyrene	PYR	125. Aroclor 1254	PCB254
89. Butylbenzyl phthalate	BBZP	126. Aroclor 1260	PCB260
90. 3,3'-Dichlorobenzidine	33DCBD		
91. Benzo(a)anthracene	BAANTR	Dioxin	
92. Bis(2-ethylhexyl) phthalate	B2EHP		
93. Chrysene	CHRY	127. 2,3,7,8-TCDD	
94. Di-n-octyl phthalate	DNOP		
95. Benzo(b)fluoranthene	BBFANT	Metals	
96. Benzo(k)fluoranthene	BKFANT		
97. Benzo(a)pyrene	BAPYR	128. Aluminum	AL
98. Indeno(1,2,3-c,d)pyrene	ICDPYR	129. Antimony	SB
99. Dibenzo(a,h)anthracene	DBAHA	130. Arsenic	AS
100. Benzo(g,h,i)perylene	BGHIPY	131. Barium	BA
		132. Beryllium	BE
Pesticides and PCBs		133. Cadmium	CD
		134. Calcium	CA
101. Alpha-BHC	ABHC	135. Chromium	CR
102. Beta-BHC	BBHC	136. Cobalt	CO
103. Delta-BHC	DBHC	137. Copper	CU
104. Gamma-BHC (Lindane)	LIN	138. Iron	FE
105. Heptachlor	HPCL	139. Lead	PB
106. Aldrin	ALDRN	140. Magnesium	MG
107. Heptachlor epoxide	HPCLE	141. Manganese	MN
108. Endosulfan I	AENSLF	142. Mercury	HG
109. Dieldrin	DLDRN	143. Nickel	NI
110. 4,4'-DDE	PPDDE	144. Potassium	K
111. Endrin	ENDRN	145. Selenium	SE
112. Endosulfan II	BENSLF	146. Silver	AG
113. 4,4'-DDD	PPDDD	147. Sodium	NA
114. Endosulfan sulfate	ESFSO4	148. Thallium	TL
115. 4,4'-DDT	PPDDT	149. Vanadium	V
116. Endrin ketone	ENDRNK	150. Zinc	ZN
117. Methoxychlor	MEXCLR		

TABLE C.2 Explosives

Compound	USATHAMA Test Name
1,3-Dinitrobenzene	13DNB
1,3,5-Trinitrobenzene	135TNB
2,4-Dinitrotoluene	24DNT
2,6-Dinitrotoluene	26DNT
2,4,6-Trinitrotoluene (TNT)	246TNT
Cyclotetramethylenetetranitramine (HMX)	HMX
Hexahydro-1,3,5-trinitro-1,3,4-triazine (RDX)	RDX
N-methyl-N,2,4,6-tetranitroaniline (tetryl)	TETRYL
Nitrocellulose	NC
Nitroglycerin	NG

TABLE C.3 Macroparameters

Sulfate	Chloride
Calcium	Sodium
Field pH	Field specific conductance
Total dissolved solids	Depth to groundwater

TABLE C.4 TCLP Parameters

Metals	
Arsenic	Lead
Barium	Mercury
Cadmium	Selenium
Chromium	Silver
Organics	
Benzene	Hexachlorobenzene
Carbon Tetrachloride	Hexachlorobutadiene
Chlordane	Hexachloroethane
Chlorobenzene	Methoxychlor
Chloroform	Methyl ethyl ketone
o-Cresol	Nitrobenzene
m-Cresol	Pentachlorophenol
p-Cresol	Pyridine
2,4-D	Tetrachloroethylene
1,4-Dichlorobenzene	Toxaphene
1,2-Dichlorobenzene	Trichloroethylene
1,1-Dichloroethylene	2,4,5-Trichlorophenol
2,4-Dinitrotoluene	2,4,6-Trichlorophenol
Endrin	2,4,5-TP (Silvex)
Heptachlor (and its hydroxide)	Vinyl Chloride

Source: Federal Register Vol. 55, No. 61, pp. 11798-11877, March 29, 1990.

TABLE C.5 Herbicides

2,4-D	2,4,5-TP (Silvex)
Dacthol	Dicamba
Ammate "X"	Dowpon
Hyver	Dinoseb
Dichloroprop	MCPA
2,4-DB	MCPP

Sources: Rigassio et al 1975; Analyte Comparison List for TCL, PPL, and SW-846.

TABLE C.6 Selected Propellant Components[a]

Explosives	Metals
Nitrocellulose	Chromium (+6)
Nitroglycerin	Lead
HMX	
RDX	Other
PETN	Diphenylamine
TNT	2-Nitrodiphenylamine
	Nitrate
Phthalates	
Di-n-butyl phthalate	
Diethyl phthalate	
Dioctyl phthalate	

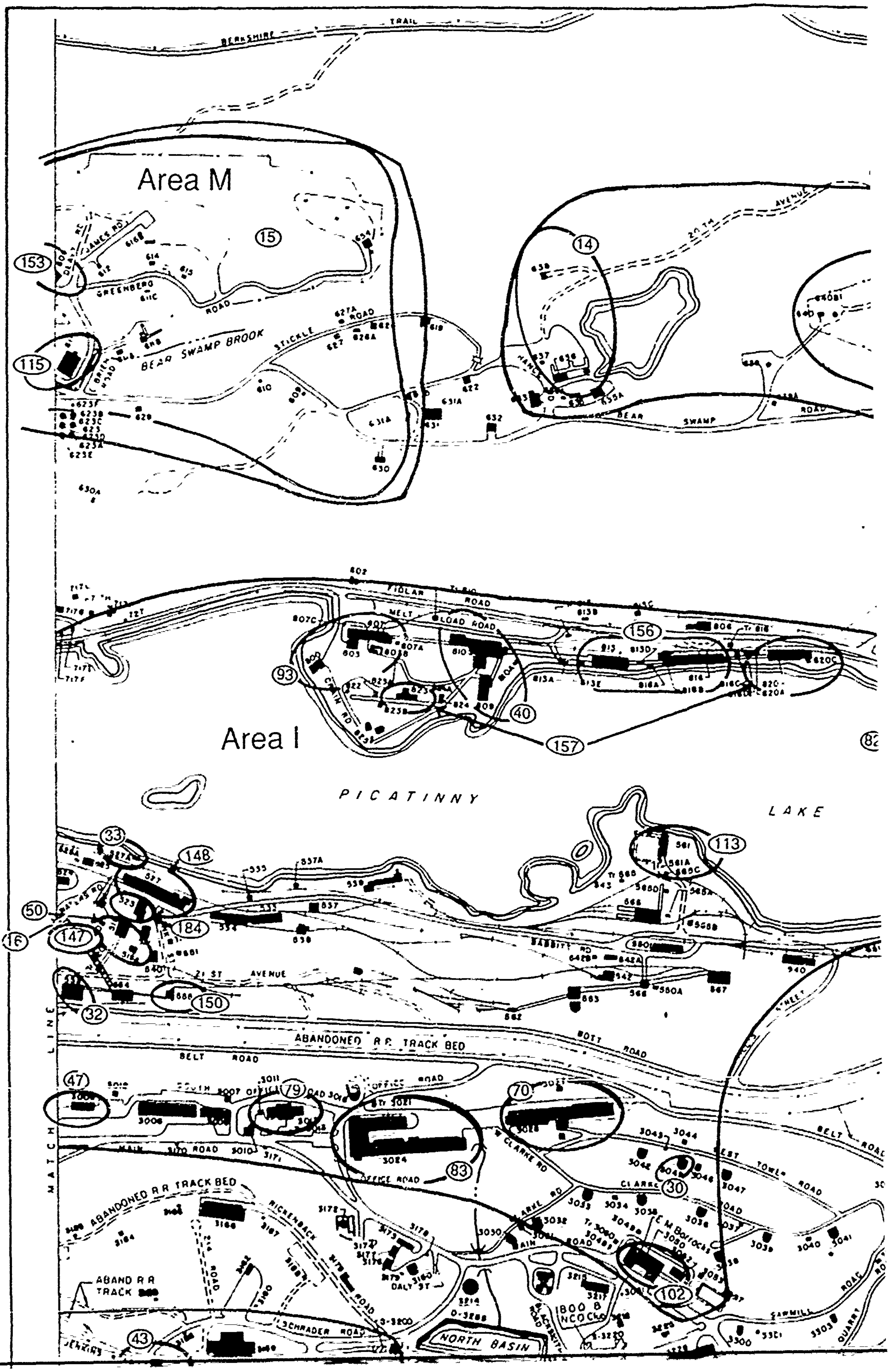
[a]Propellants are listed as analytical category 8 in Tables 5.2-5.4 (see Sec. 5.3 of this volume).

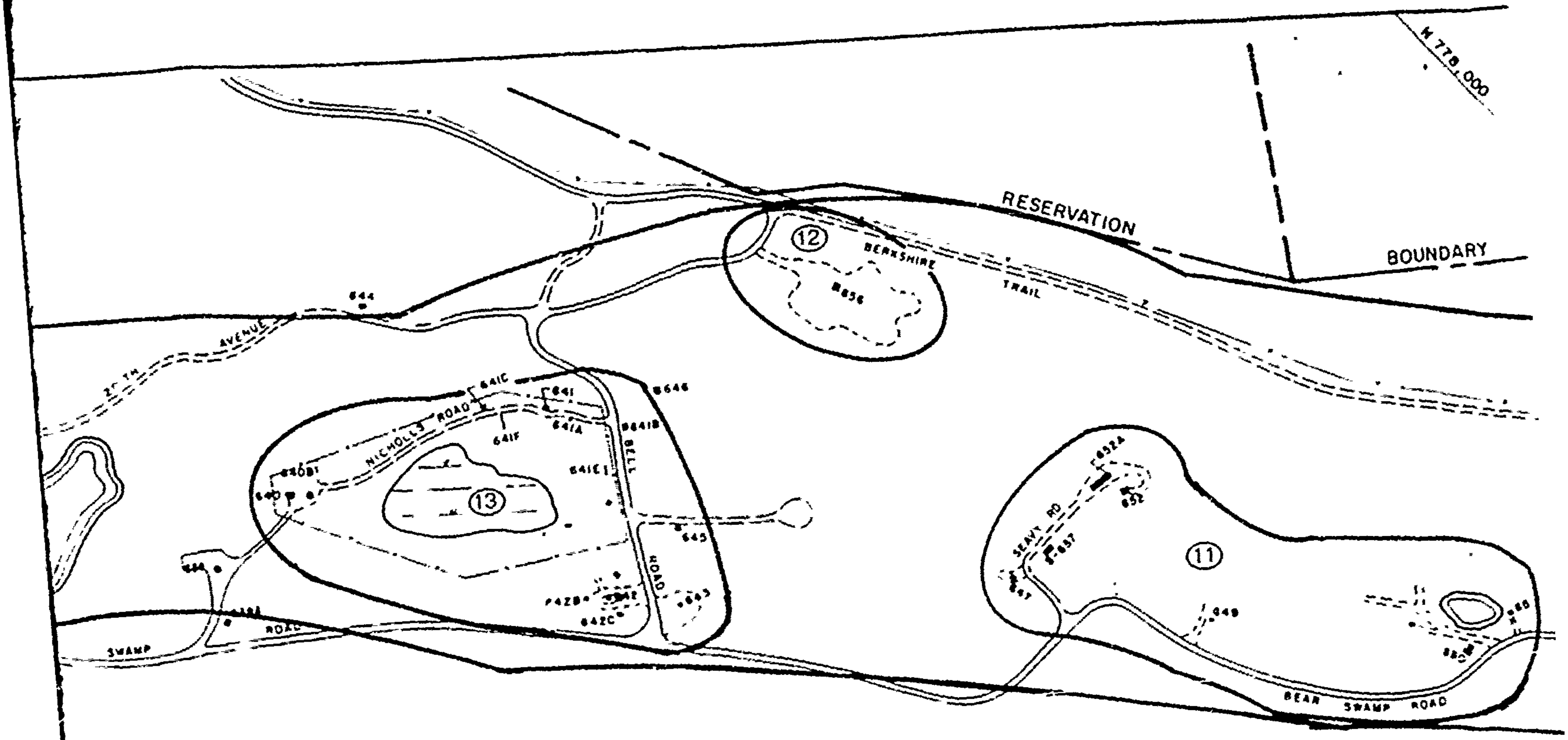
TABLE C.7 Explosives and Propellants[a]

Explosives	
13DNB	**Metals**
135TNB	Chromium (+6)
24DNB	Lead
24DNT	
26DNT	**Phthalates**
246TNT	Di-n-butyl phthalate
HMX	Diethyl phthtalate
RDX	Dioctyl phthtalate
Tetryl	
NC	**Other**
NG	Diphenylamine
PETN	2-Nitrodiphenylamine
	Nitrate

[a]This table combines analytes from Tables C.2 and C.6.

CORPS OF ENGINEERS

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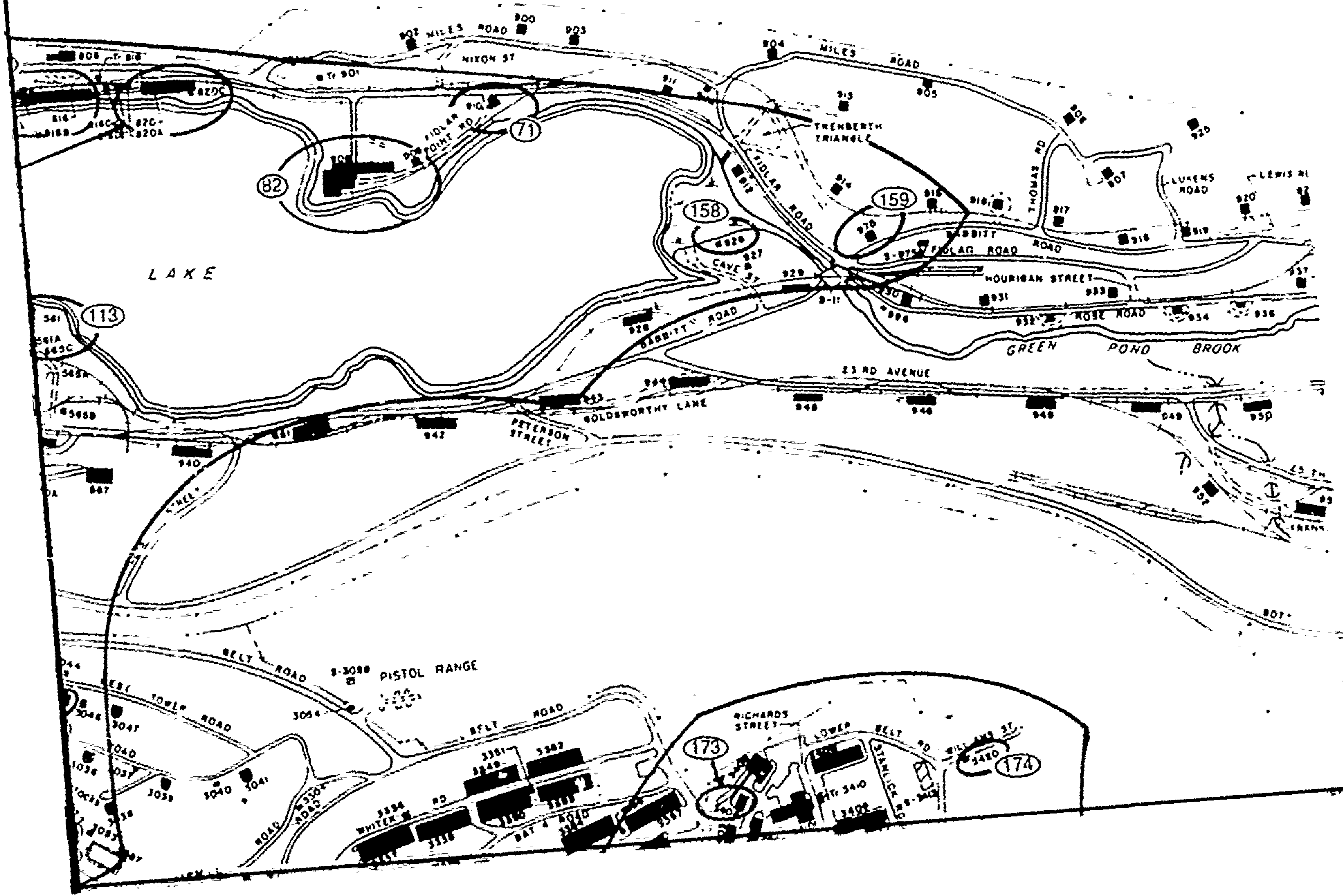
13
11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FIDLAR ROAD
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ROSE ROAD
GREEN POND BROOK
CAVE ST
23 RD AVENUE
GOLDSWORTHY LANE
PETERSON STREET
LAKE
BELT ROAD
PISTOL RANGE
LOWER BELT RD
RICHARDS STREET
WILLIAMS ST
STANLICK
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159
113
173
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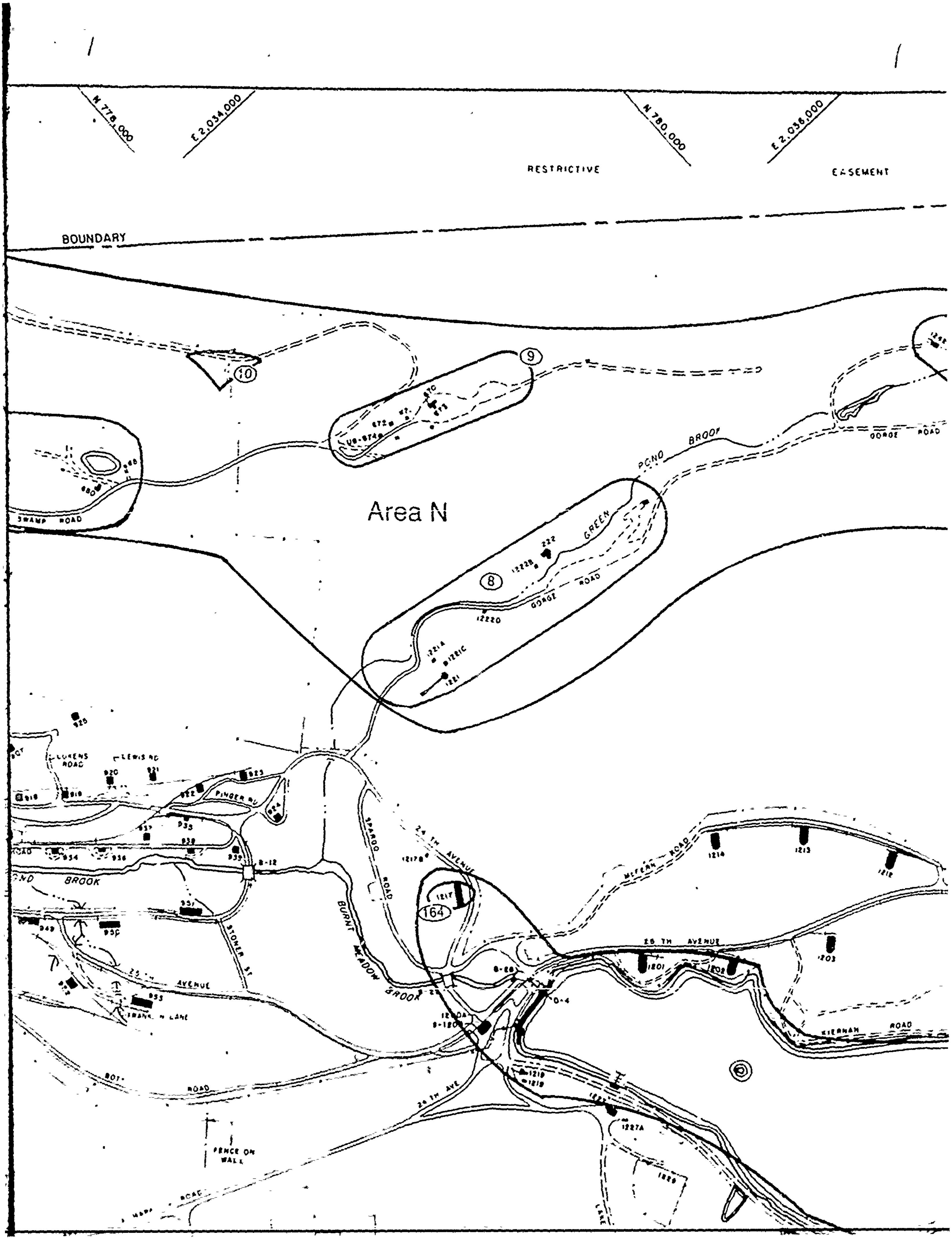
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E 2,034,000
N 780,000
E 2,036,000
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EASEMENT
BOUNDARY
Area N
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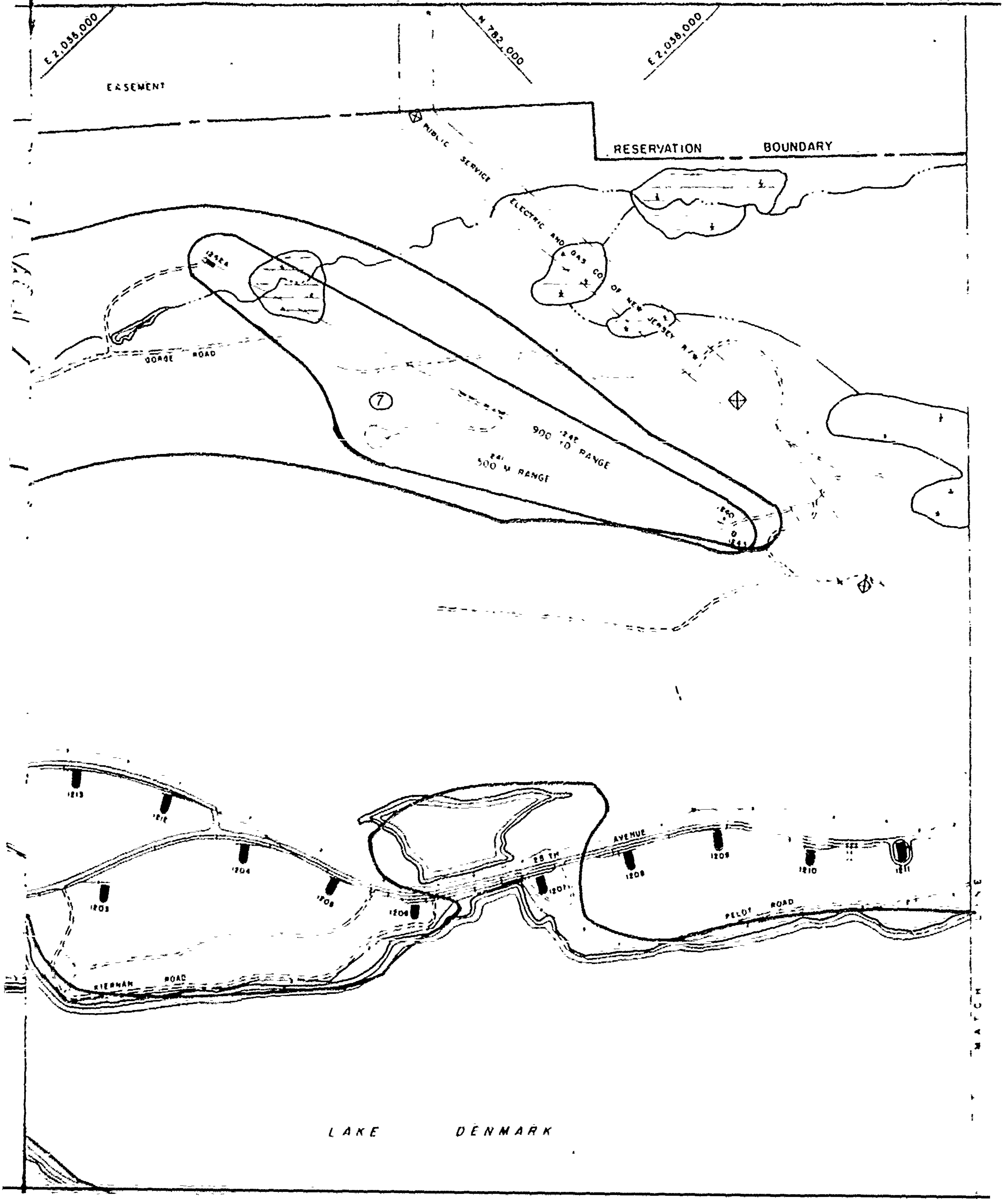
10
8
164
SWAMP ROAD
POND BROOK
GREEN
GORGE ROAD
LUKENS ROAD
LEWIS RD
PINGER RD
SPARGO ROAD
24 TH AVENUE
BURNT MEADOW BROOK
STONER ST
McFERN ROAD
25 TH AVENUE
KIERNAN ROAD
FRANKLIN LANE
BOT- ROAD
24 TH AVE
FENCE ON WALL
LANE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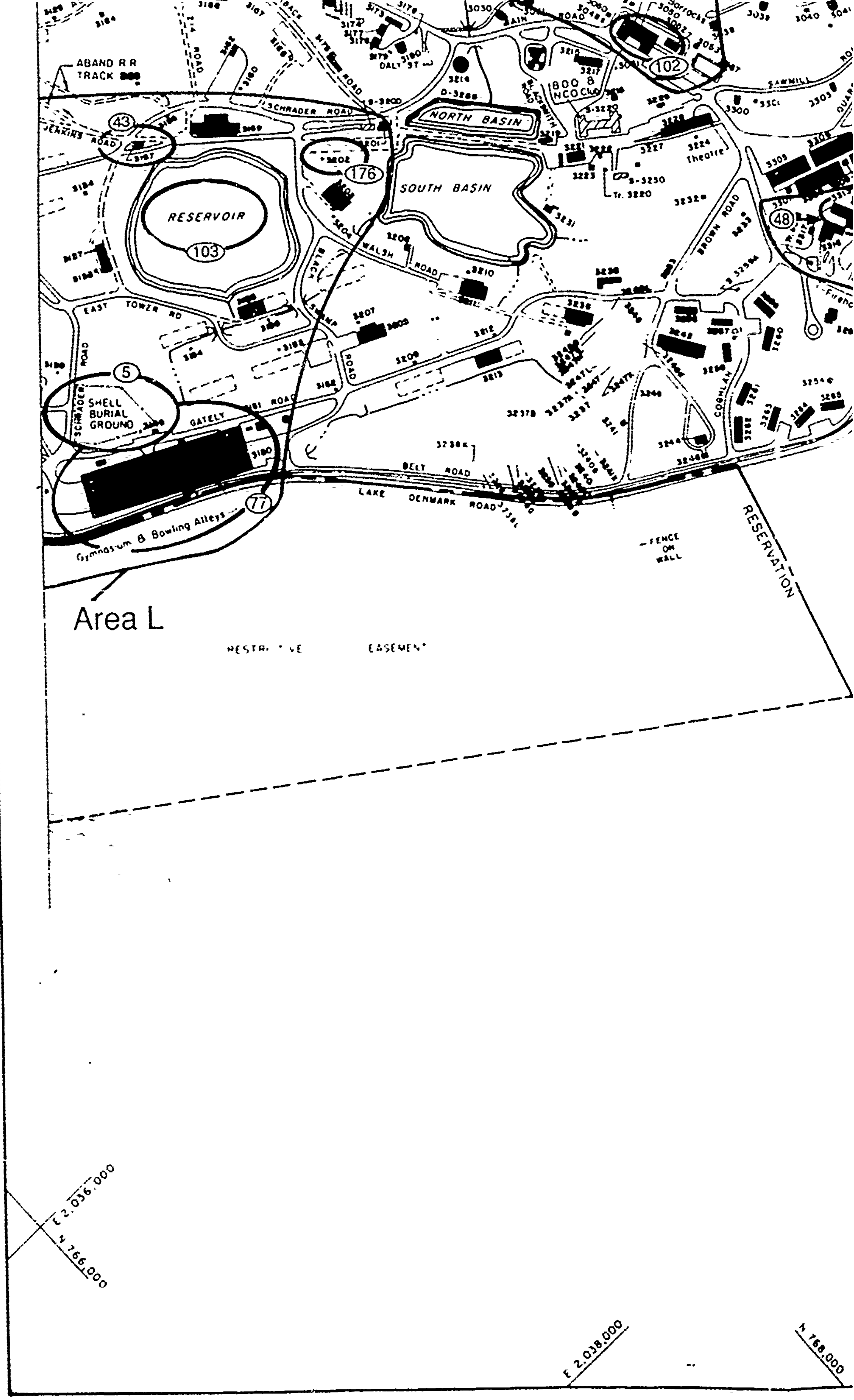
PUBLIC SERVICE ELECTRIC AND GAS CO OF NEW JERSEY R/W
GORGE ROAD
7
900 YD RANGE
500 M RANGE
AVENUE
25 TH
PELOT ROAD
KIERNAN ROAD
1213
1212
1204
1203
1205
1206
1207
1208
1209
1210
1211
LAKE DENMARK
MATCH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SCHRADER ROAD
NORTH BASIN
SOUTH BASIN
RESERVOIR
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176
43
102
48
800 &
NCO Club
Theatre
Barracks
SAWMILL
WALSH ROAD
BLACK SWAMP ROAD
BROWN ROAD
COGHLAN
EAST TOWER RD
SCHRADER ROAD
5
SHELL
BURIAL
GROUND
GATELY ROAD
77
Gymnasium & Bowling Alleys
BELT ROAD
LAKE DENMARK ROAD
FENCE ON WALL
RESERVATION
Area L
EASEMENT
E 2,036,000
N 766,000
E 2,038,000
N 768,000

Area K
RESERVATION
BOUNDARY
Firehouse
Theatre
PX & Commissary
BROWN ROAD
SAWMILL
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HART
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BASIN
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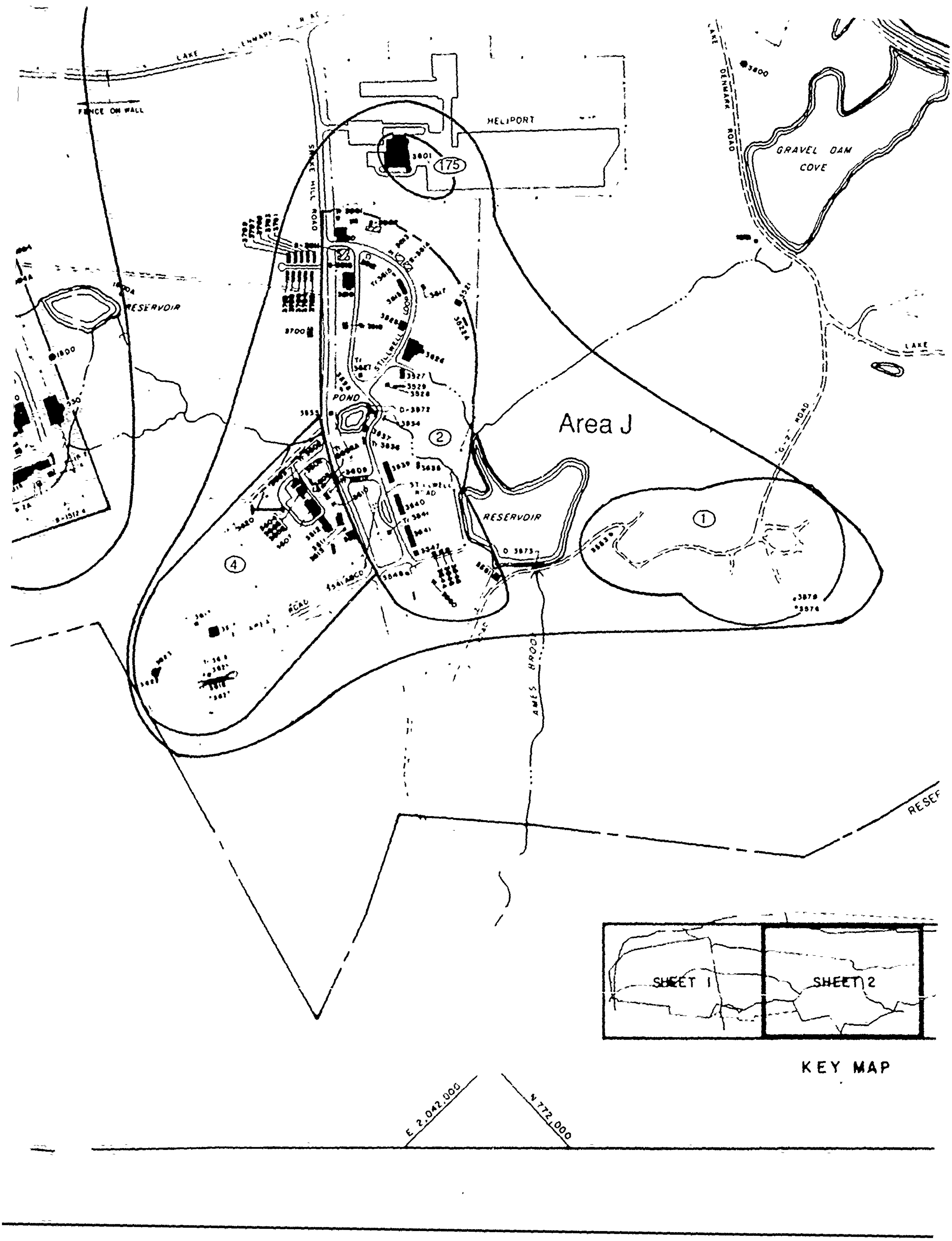

FENCE ON WALL
HELIPORT
GRAVEL DAM COVE
LAKE DENMARK ROAD
RESERVOIR
POND
STILLWELL LOOP
STILLWELL ROAD
Area J
175
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2
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AMES BROOK
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SHEET 1
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KEY MAP
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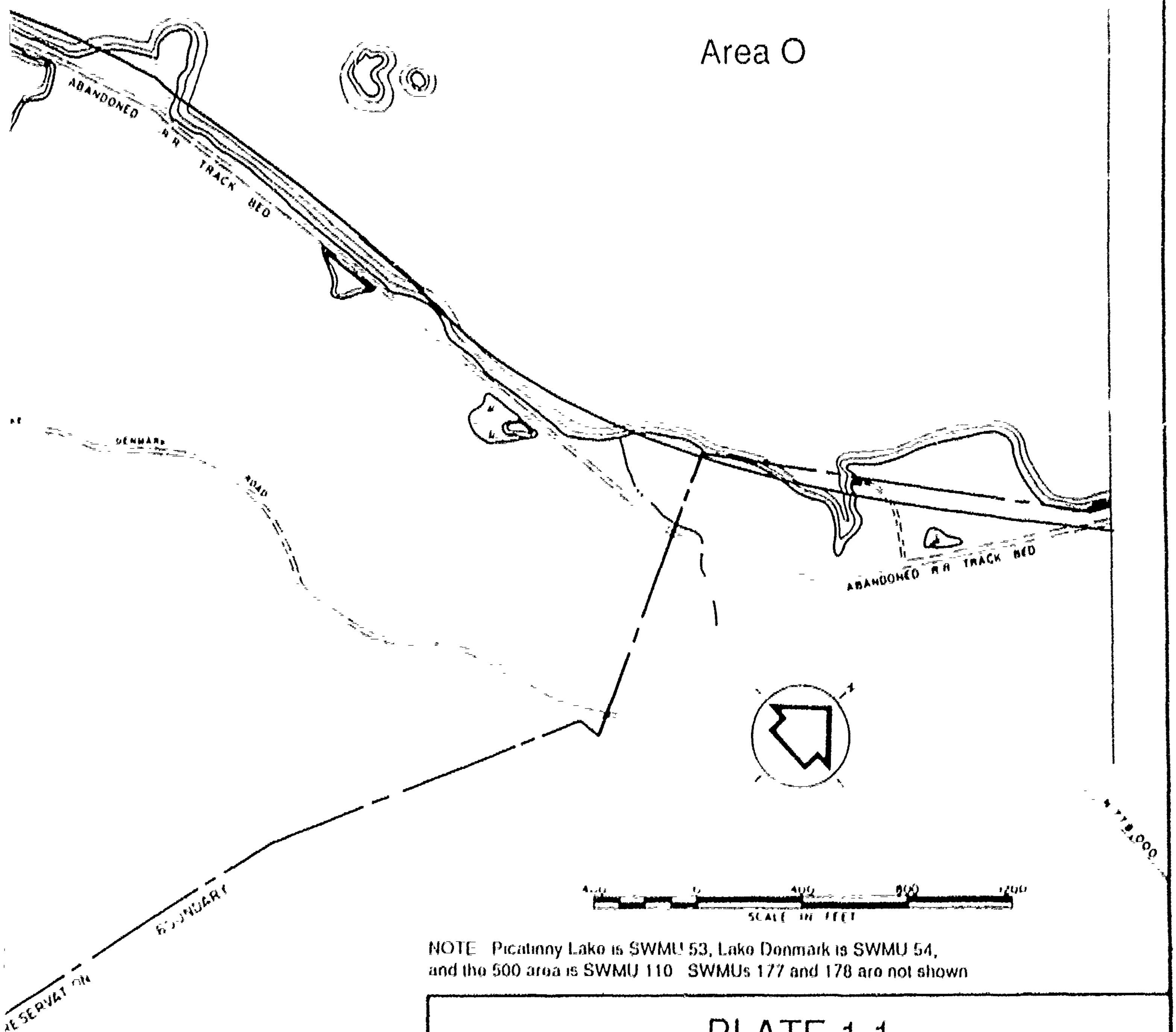


NOTE Picatinny Lake is SWMU 53, Lake Denmark is SWMU 54, and the 500 area is SWMU 110 SWMUs 177 and 178 are not shown

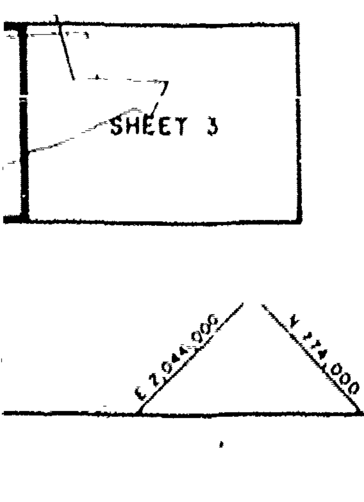


PLATE 1.1

JOHN J. KASSNER & CO., INC
ARCHITECT ENGINEER
LAKE SUCCESS, NEW YORK

CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
NEW YORK DISTRICT - NEW YORK NEW YORK

MASTER PLAN MAP OF PICATINNY ARSENAL SHOWING REMEDIAL INVESTIGATION SITES (CONTINUED)

RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

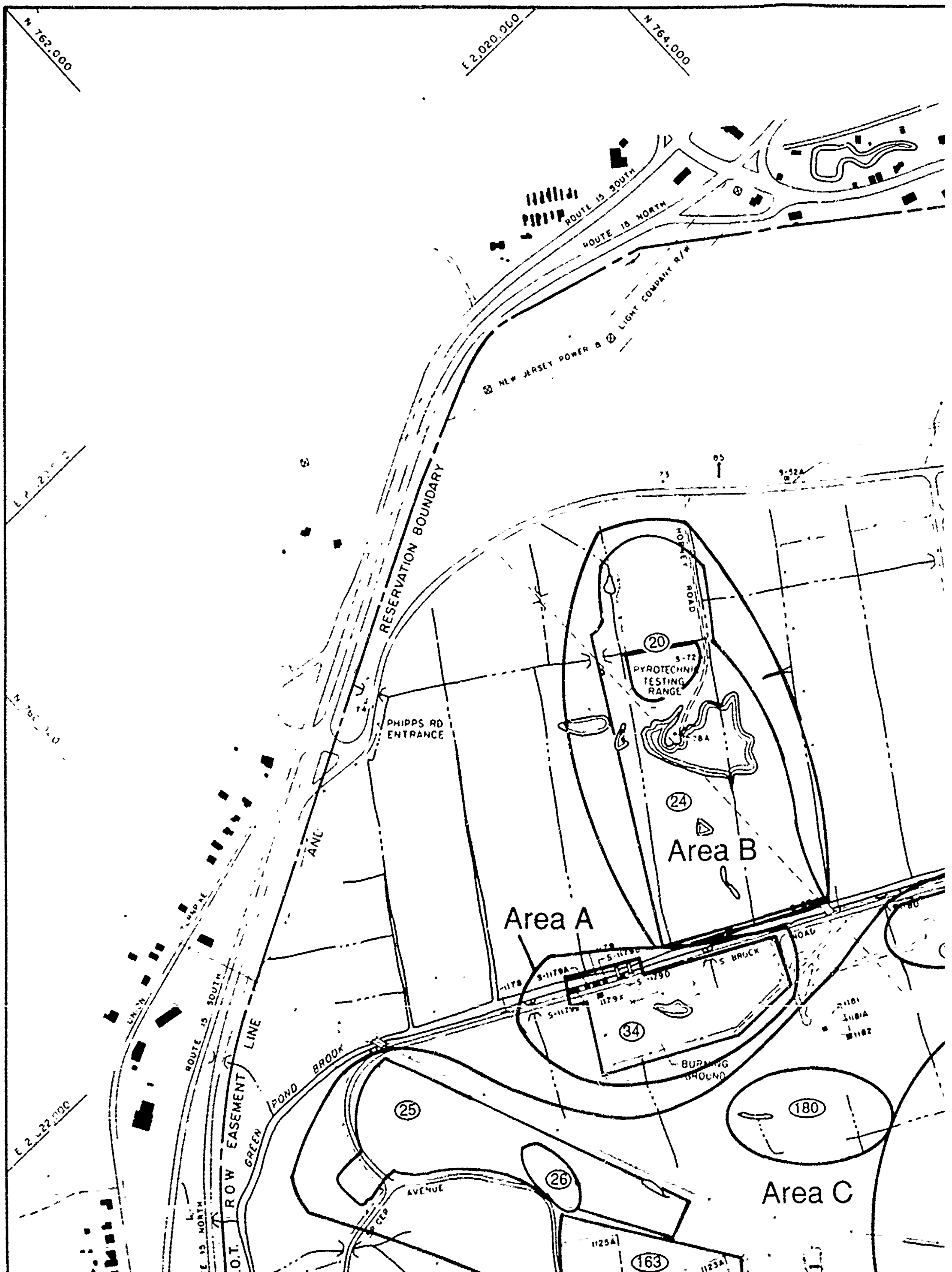
DATE

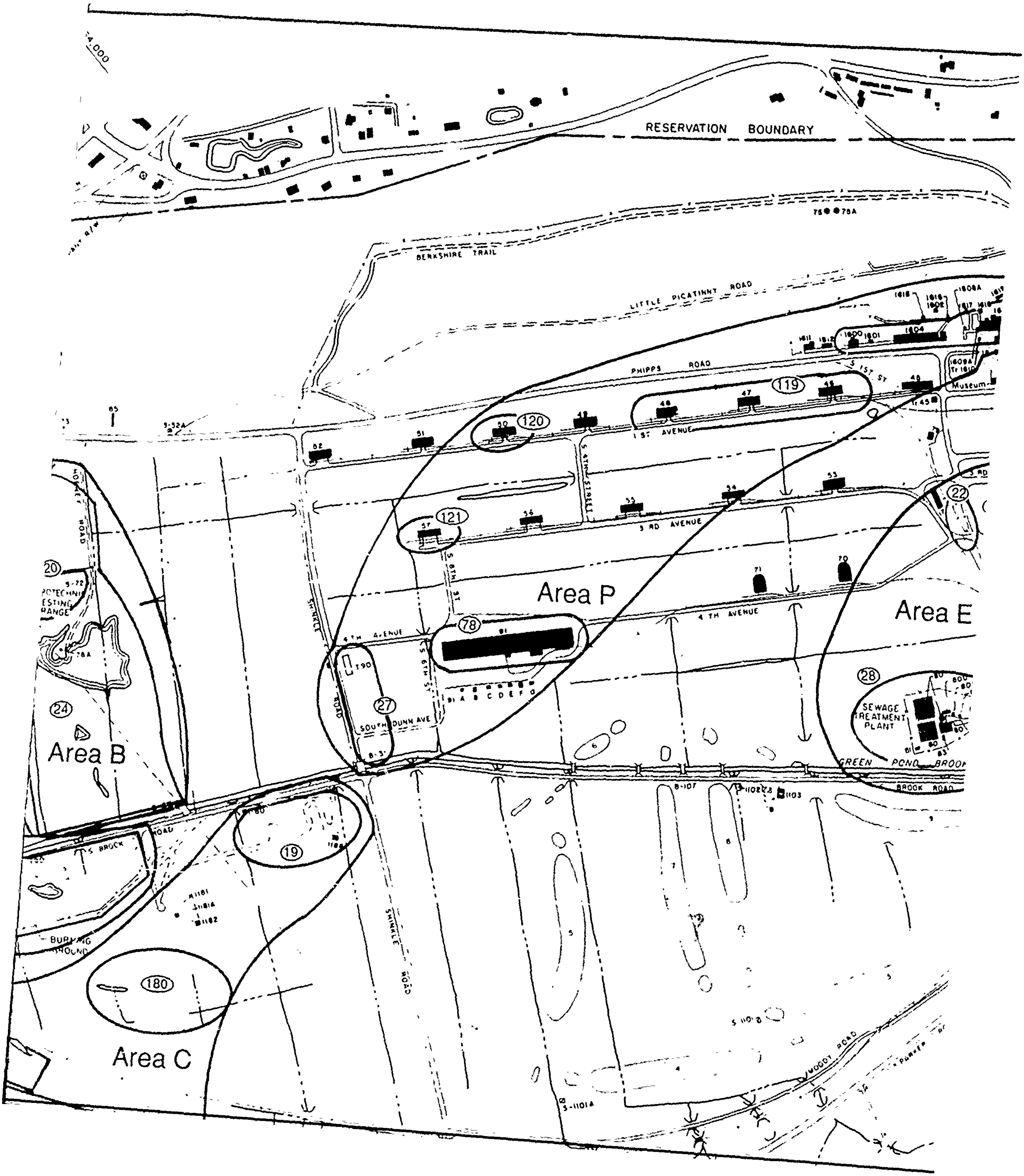
REVIEWED & COMMENTED ON BY MAJOR COMMANDER & FORWARDED TO THE CHIEF OF ENGINEERS

DATE

DATE	DRAWING NO
SHEET NO	FILE NO
2 OF 2	

CORPS OF ENGINEERS

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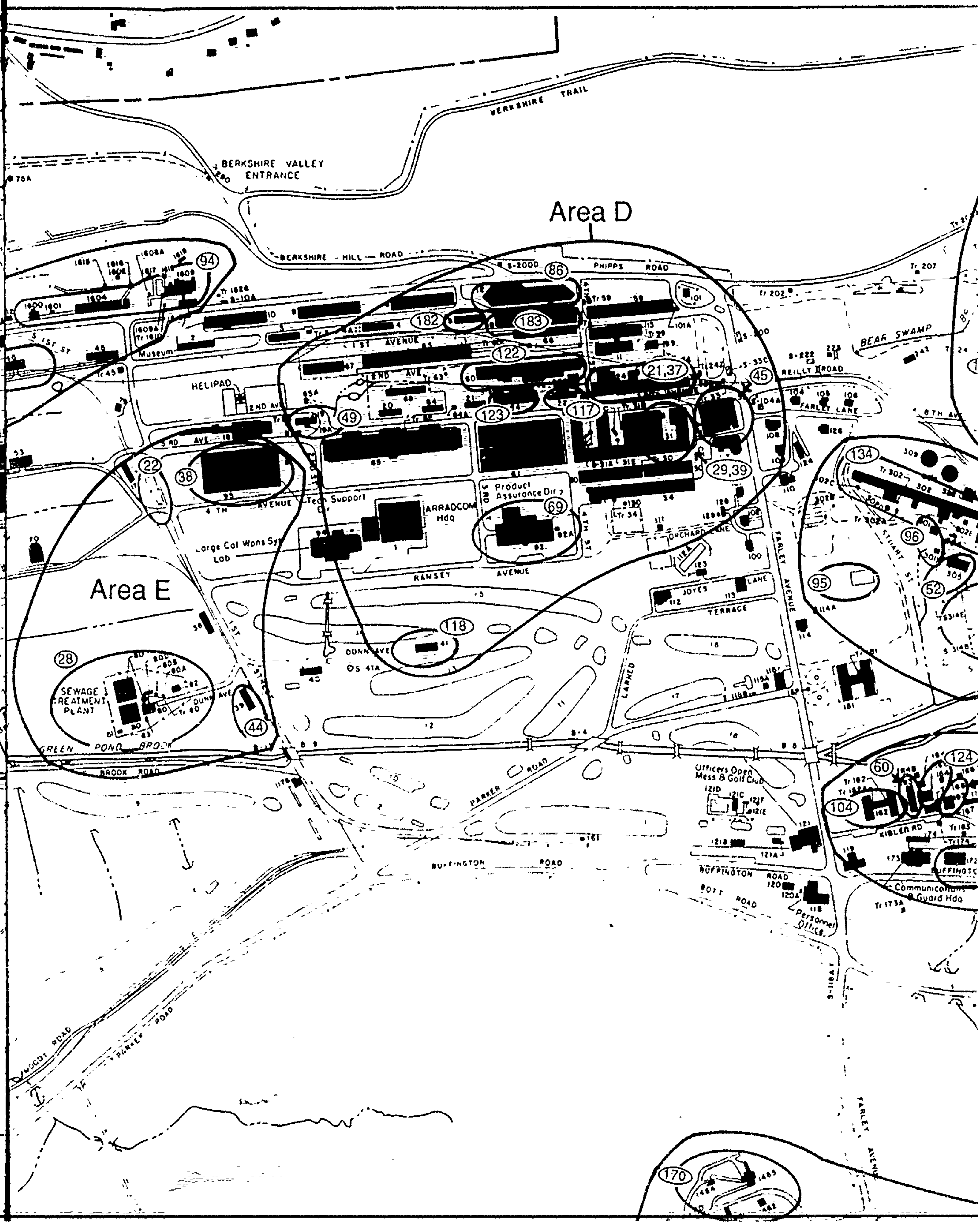
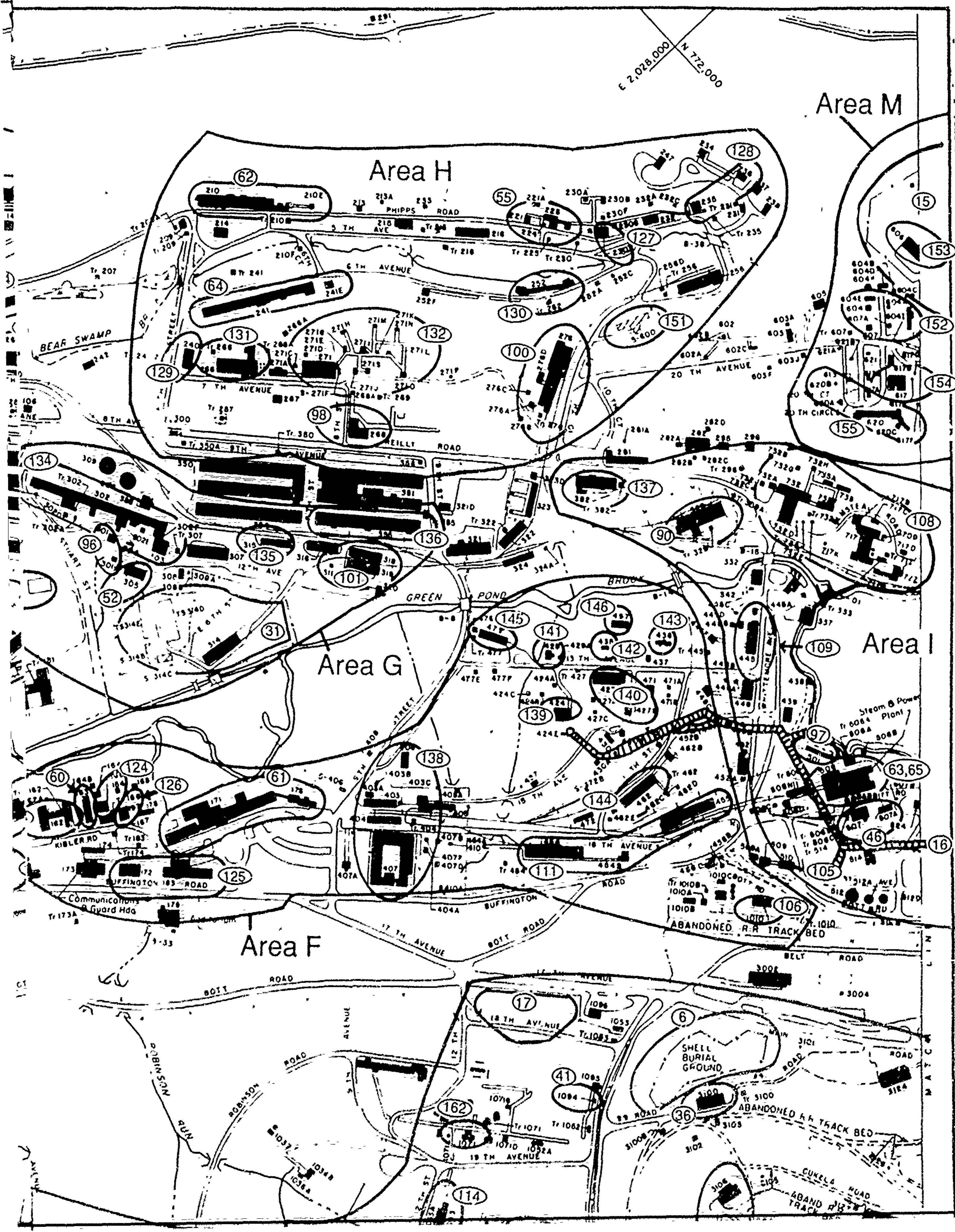
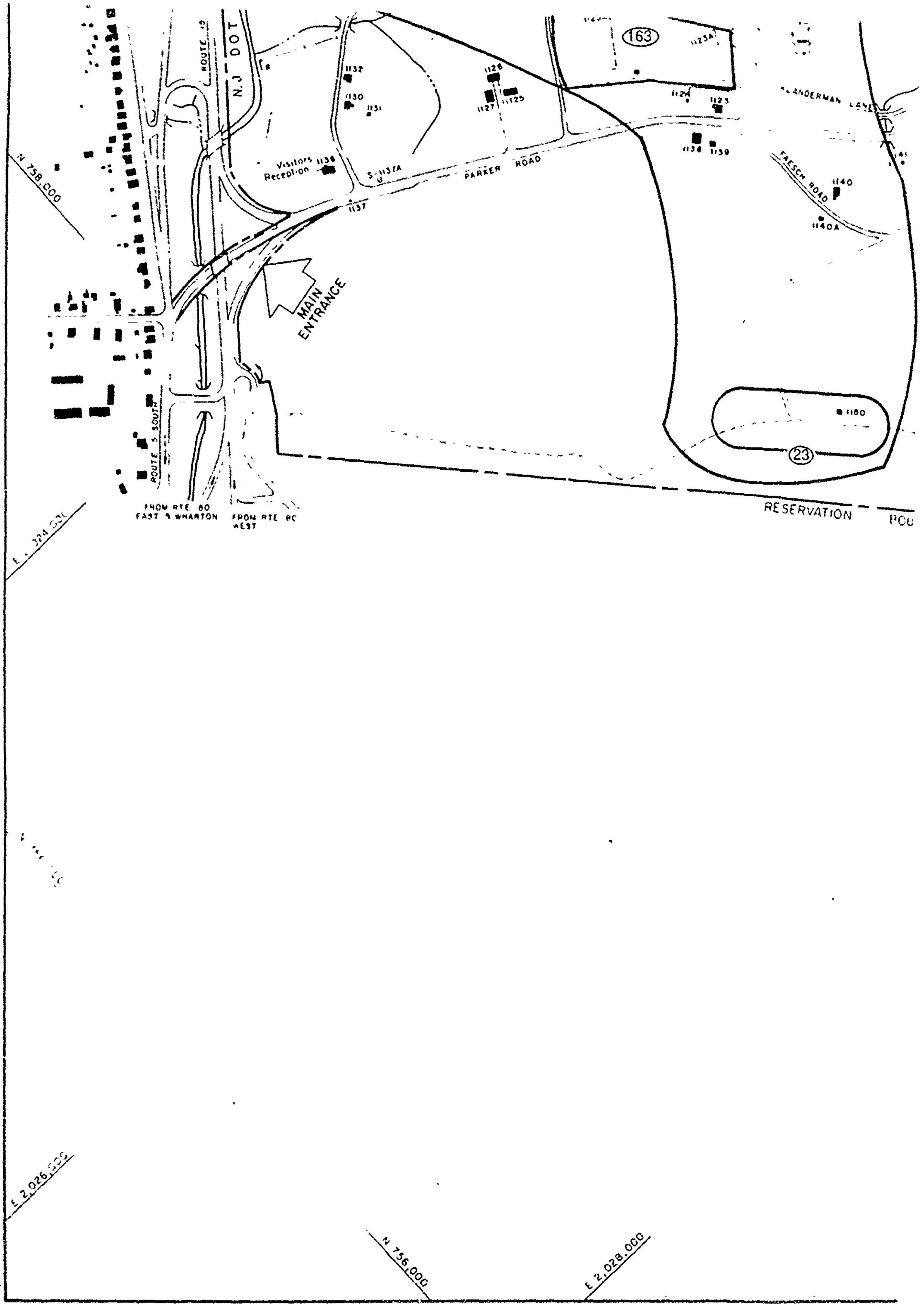
LITTLE PICATINNY ROAD
PHIPPS ROAD
1ST AVENUE
3 RD AVENUE
4 TH AVENUE
S 4TH STREET
S 6TH ST
SHINKLE ROAD
SOUTH DUNN AVE
S BROCK ROAD
GREEN POND BROOK
BROOK ROAD
MOODY ROAD
BURYING GROUND
PYROTECHNIC TESTING RANGE
SEWAGE TREATMENT PLANT
Museum
Area P
Area E
Area B
Area C
119
120
121
78
27
22
28
20
24
19
180

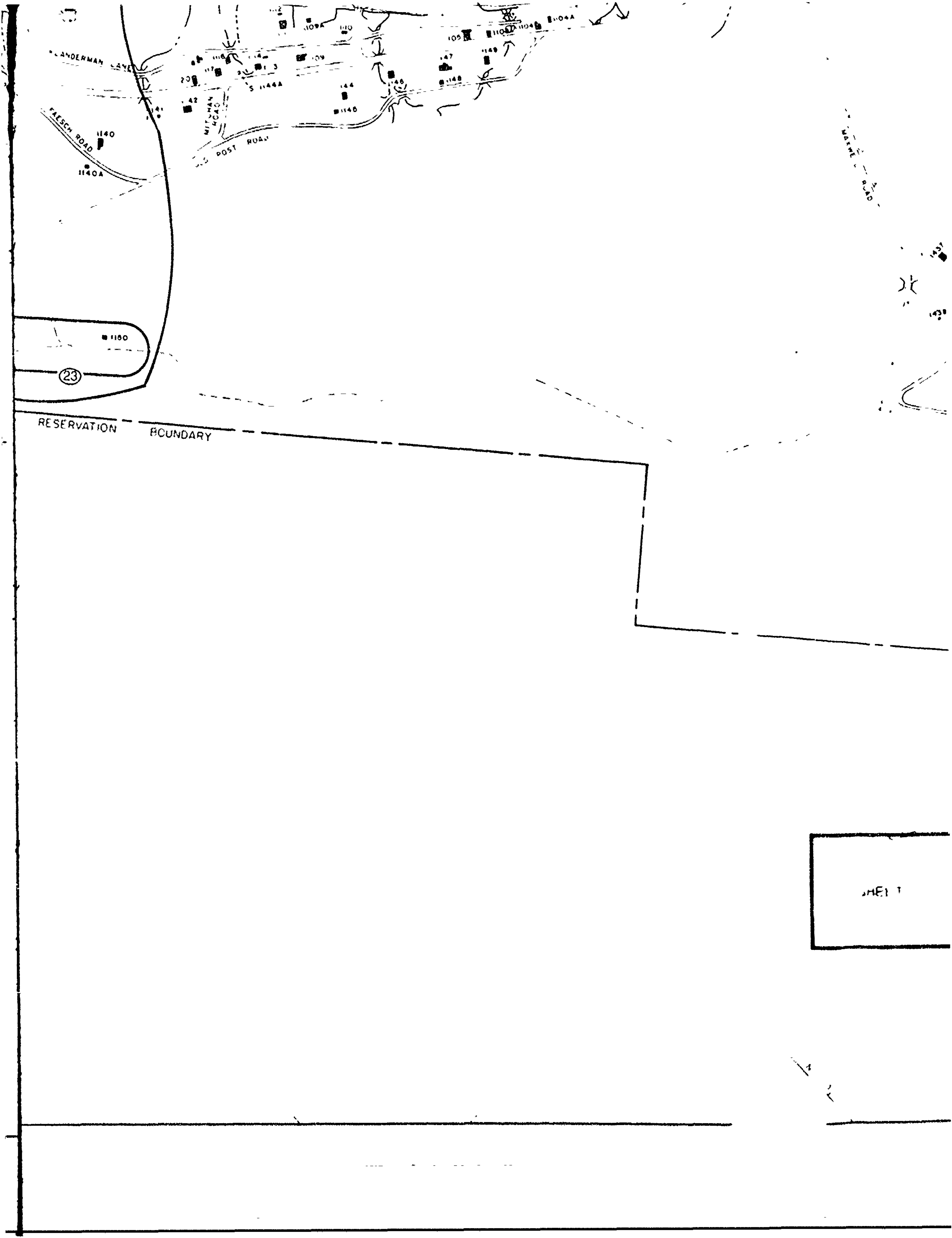

Area D
Area E
BERKSHIRE TRAIL
BERKSHIRE VALLEY ENTRANCE
BERKSHIRE HILL ROAD
PHIPPS ROAD
BEAR SWAMP
REILLY ROAD
FARLEY LANE
1ST AVENUE
2ND AVE
3RD AVE
4TH AVENUE
HELIPAD
Museum
Tech Support
ARRADCOM Hdq
Product Assurance Dir
Large Cal Wpns Sys Lab
RAMSEY AVENUE
ORCHARD LANE
JOYES LANE
TERRACE
FARLEY AVENUE
DUNN AVE
SEWAGE TREATMENT PLANT
GREEN POND BROOK
BROOK ROAD
PARKER ROAD
BUFFINGTON ROAD
BOTT ROAD
KIBLER RD
Officers Open Mess & Golf Club
Personnel Office
Communications & Guard Hdq
MOODY ROAD
STUART ST
LARNED

U. S. ARMY

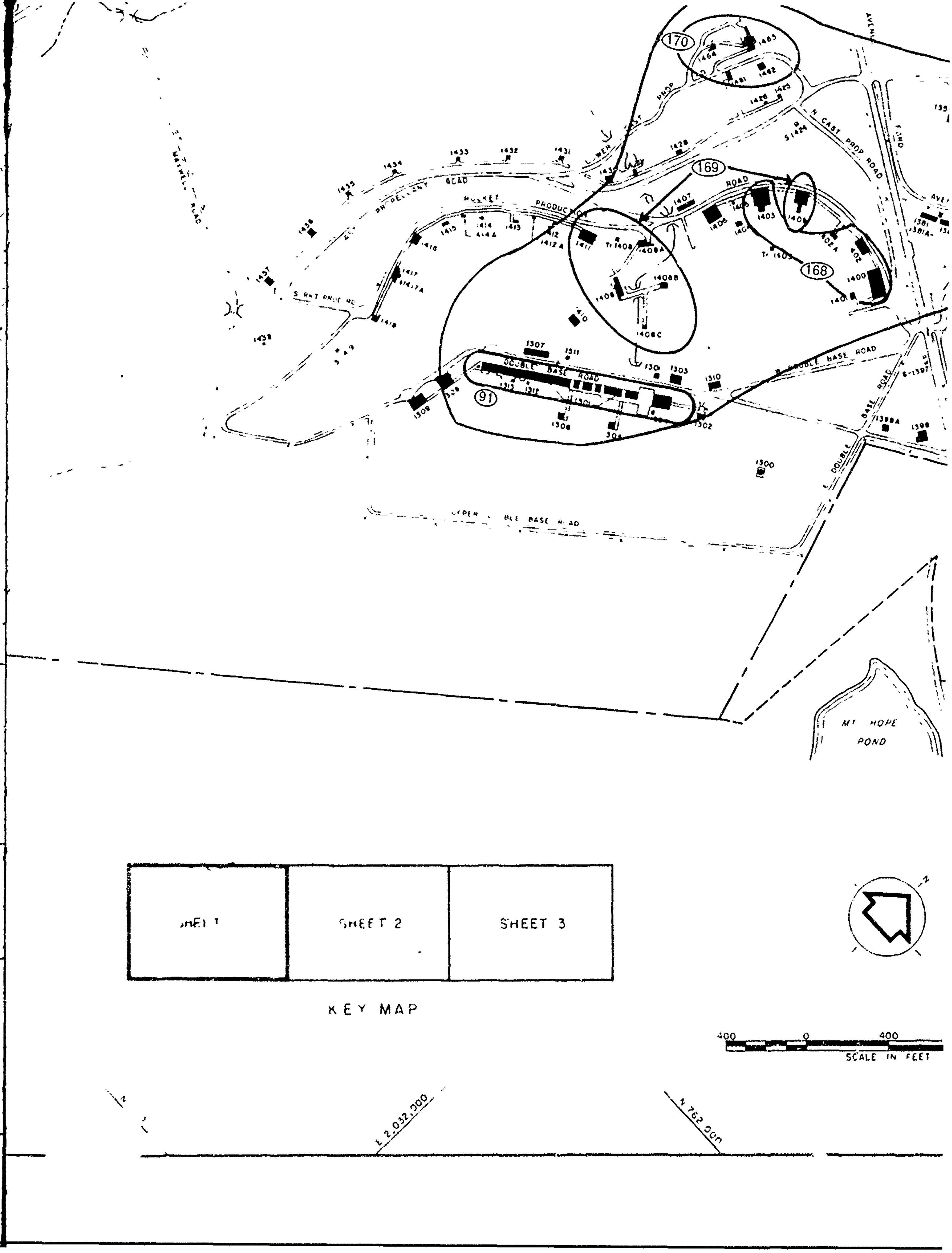


Area H
Area M
Area G
Area I
Area F
E 2,028,000
N 772,000
BEAR SWAMP
PHIPPS ROAD
5 TH AVE
6 TH AVENUE
7 TH AVENUE
8 TH AVE
20 TH AVENUE
GREEN POND BROOK
KIBLER RD
BUFFINGTON ROAD
Communications & Guard Hdq
17 TH AVENUE
BOTT ROAD
BELT ROAD
ABANDONED R.R TRACK BED
18 TH AVENUE
19 TH AVENUE
SHELL BURIAL GROUND
ROBINSON RUN
ROBINSON ROAD
Steam & Power Plant


163
1123A
1124
1123
ANDERMAN LANE
1126
1132
1130
1131
1127
1125
1138
1139
FAESCH ROAD
1140
1140A
Visitors Reception
1136
S-1137A
PARKER ROAD
1137
N.J. DOT
ROUTE 15
N 758,000
MAIN ENTRANCE
1160
23
ROUTE 15 SOUTH
FROM RTE 80 EAST & WHARTON
FROM RTE 80 WEST
RESERVATION
E 2,026,000
N 756,000
E 2,028,000



FAESCH ROAD
1140
1140A
POST ROAD
1109A
1104A
1148
1180
23
RESERVATION BOUNDARY


170
169
168
91
ROCKET PRODUCTION ROAD
PROPELLANT ROAD
N CAST PROP ROAD
DOUBLE BASE ROAD
S RKT PROD RD
MAXWELL ROAD
UPPER BASE ROAD
MT HOPE POND
SHEET 2
SHEET 3
KEY MAP
400
0
400
SCALE IN FEET
E 2,032,000
N 762,000
1300
1301
1302
1303
1305
1306
1307
1309
1310
1311
1313
1400
1401
1402
1402A
1403
1405
1406
1407
1408
1408A
1408B
1408C
1409
1410
1411
1412
1412 A
1413
1414
1414 A
1415
1416
1417
1417A
1418
1425
1426
1428
1431
1432
1433
1434
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1398A
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S1424
1381
1381A

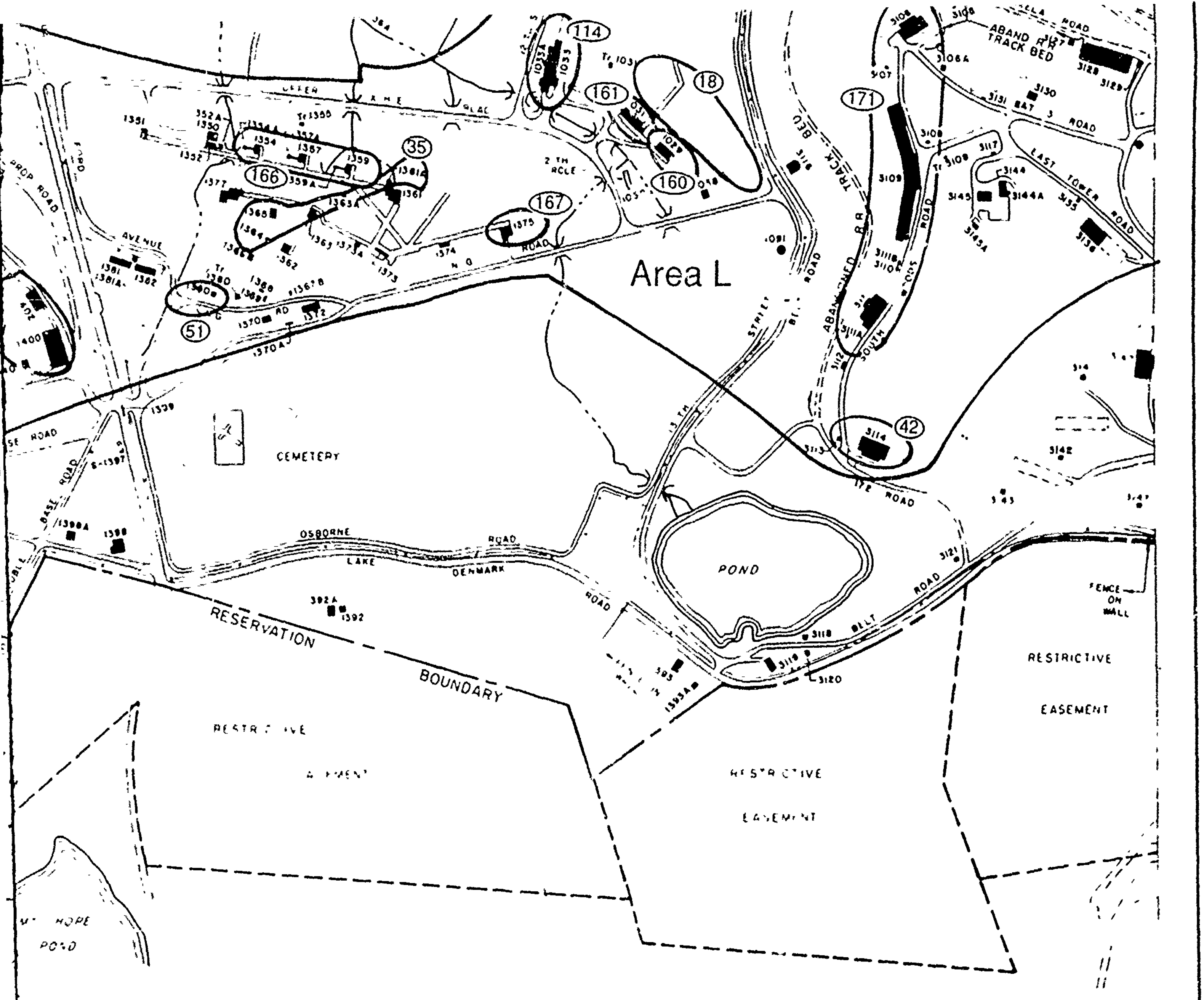

PLATE 1.1

JOHN J. KASSNER & CO., INC. ARCHITECT - ENGINEER LAKE SUCCESS, NEW YORK	CORPS OF ENGINEERS - U. S. ARMY OFFICE OF THE DISTRICT ENGINEER NEW YORK DISTRICT NEW YORK, NEW YORK

MASTER PLAN MAP OF PICATINNY ARSENAL SHOWING REMEDIAL INVESTIGATION SITES (BOUNDARIES ARE APPROXIMATE)

RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

DATE

REVIEWED & COMMENTED ON BY MAJOR COMMANDER & FORWARDED TO THE CHIEF OF ENGINEERS	DATE	DRAWING NO
DATE	SHEET NO 1 OF 2	FILE NO